KALRO
Kenya Agricultural & Livestock Research Organization

NAVCDP
NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT

Inventory of Climate Smart Agriculture Technologies, Innovations and Management Practices for Rice Value Chain

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DISCLAIMER

The information presented in this inventory of the Technologies, Innovations and Management Practices (TIMPs) book is for advisory use only. Users of this book should verify site specific details that relate to their agro-climatic zones from their area agricultural extension officers.

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FOREWORD

The Kenya Agricultural and Livestock Research Organization (KALRO) through the Kenya Climate Smart Agriculture Project (KCSAP) and National Agricultural and Rural Inclusive Growth Project (NARIGP) laid down a strong foundation for commercialization of agriculture in Kenya. This was done through the development of Climate Smart Technologies, Innovations and Management Practices (TIMPs) and Training of Trainers (ToTs) manuals for 27 value chains through KCSAP and 5 value chains through NARIGP as well as the accompanying training for the master trainers for the two projects. During this phase, KALRO conducted 51 adaptive and 80 applied research projects through which additional TIMPS were developed and validated, with some of the research gaps identified earlier addressed. A notable inclusion was the integration of digital information into the value chains through the Big Data Platform. These are achievements the National Agricultural Value Chain Development Project (NAVCDP) seeks to build on to deepen investments into interventions on productivity enhancement, community led farmer extension, water management investments and data driven value chain services.In this project, KALRO seeks to reinforce, customize and update the existing inventories of TIMPs, with emphasis on climate resilience, nutrition, and safer food production practices. With the continued support, KALRO will also continue supporting quality technical assistance for value chain development at all levels and build capacity of county level implementation units to anchor project activities. With the support of NAVCDP, KALRO has developed TIMPs for the two new value chains, pyrethrum and rice and will continue updating inventories of TIMPs for all the other value chains developed during the implementation of KSCAP/NARIGP. In doing so, KALRO will seek to further strengthen climate resilience and enhancement of value addition aspects of the updated TIMPS. Through NAVCDP, KALRO will continue updating digital integration of value chains with information that will become accessible. To enhance effective coordination of research linkages and agriculture digitization, KALRO and the Ministry of Agriculture and Livestock Development have put in a relevant support mechanism to oversee implementation of these activities.

Extensive information from research and background data has been used to develop this rice TIMPs inventory. To disseminate the TIMPs, a Training of Trainers (ToT) manual has been developed. The design of the manual takes into consideration the delivery system, partners and their roles, duration of training and logical flow of the modules. The training modules have uniform outline that ensures every aspect of the TIMPs are fully covered in way that the trainees can absorb and relate to. Various delivery methods are deployed and where possible demonstrations and practical work are incorporated to enable the trainees learn by participating in the actual field activities. The use of this TIMPs inventory is expected to contribute to the achievement of the Project Development Objective (PDO), which is to increase market participation and value addition for targeted farmers in select value chains in project areas. This TIMPs inventory is to be used in conjunction with the respective rice ToT Manual.

Finally, I am greatly indebted to the value chain leaders and all those who participated in the preparation of this Inventory of TIMPs for the Rice Value Chain. It is expected to herald new ways of delivering training content that will enable realization of the project objectives and aspirations.

Eliud K. Kireger, PhD, OGW
Director General, KALRO

PREFACE

The National Agricultural Value Chain Development Project (NAVCDP) is a Government of Kenya project with support from the World Bank. The five-year project is being implemented in 32 counties clustered in seven regions at an approximate cost of U$ 275 million. The project development objective (PDO) is "increase market participation and value addition for targeted farmers in select value chains in project areas." It is expected that this objective will be achieved through implementing the five project components, namely; Building Producer capacity for climate resilient stronger value chains; Climate Smart Value Chain Ecosystem Investments; Piloting Climate Smart Safer Urban Food Systems; Project Coordination and Management; and Contingent Emergency Response Component.

The National Agricultural Value Chain Development Project aims to support 3.8 million small-scale farmers transitioning or with the potential to transition from subsistence farmers to commercial farmers or are selling only a small percentage of their produce commercially. Additional beneficiaries of the Project include value chain actors at various levels, the extension workers, aggregators, logistics support providers and SMEs operating within the value chain. The Project places a strong focus on inclusion of women farmers within the supported Value Chains (VCs). Thirteen VC's have been selected based on a thorough qualitative and quantitative assessment of their potential. The selected VCs based on their ranking are: Dairy, Coffee, Chicken, Avocado, Banana, Mango, Irish potatoes, Tomato, Apiculture, Pyrethrum, Cashew nut, Rice and Cotton. Additional value chains prioritized by counties will be supported by their respective County Project Coordination Units.

The National Agricultural Value Chain Development Project has partnered with KALRO to further strengthen and expand the existing inventory of TIMPs with emphasis on climate resilience, nutrition, and safer food production practices. Through this partnership, KALRO will be funded to develop Technologies, Innovation and Management Practices (TIMPS) for the two new value chains-Rice and Pyrethrum, and update inventories of TIMPS for all other value chains developed during the implementation of KSCAP/NARIGP. It will also support the strengthening of the existing Big Data platform at KALRO as the foundational database for insight-driven, more productive, resource efficient and climate-resilient farming. Finally, the Ministry of Agriculture & Livestock Development (MoALD) has put in place relevant support mechanism with KALRO to oversee effective implementation, coordination of research linkages and agriculture digitization.

In developing suitable inventories of TIMPs and corresponding ToT manuals, KALRO is obliged to use its own information resources and those of its partners and collaborators. Use of these information resources, coupled with the accompanying training and contribution of the other project components, will go a long way in enabling NAVCDP to meet its development objectives.

The National Project Coordination Unit is grateful to all who participated in the development and production of this Inventory of TIMPs for rice Value Chain. It is my hope that counties and other users will put this resource to good use as they transform and reorient their agricultural systems to make them more productive and resilient while minimizing GHG emissions under the new realities of the changing climate.

Dr. Samuel Guto, PhD
National Project Coordinator
National Agricultural Value Chain Development Project

ABBREVIATIONS AND ACRONYMS

AATF	African Agricultural Technology Foundation
AES	Agricultural Engineering Services
AFA	Agriculture and Food Authority
AIP	Agricultural innovation platform
AMP	Agricultural Mechanization Policy 2021
AMS	Agricultural Mechanization Station
ATDC	Agriculture Technology Development Centre
AWD	Alternate Wetting and Drying
BT	Bacillus Thuriegensis
CABI	Center For Agriculture Biodiversity International
CaDPERP	Capacity Development Project for Enhancement of Rice Production in
CBOs	Community based organizations
CGIAR	Consortium of International Agricultural Research Centres
CIGs	Common interest groups
CMOC	Complementary Metal-Oxide Semiconductor
DAS	Days After Sowing
DAT	Days After Transplanting
FCRC	Food Crops Research Centre
FFBS	Farmer Field Business School
GHG	Green House Gas
JICA	Japan International Cooperation Agency
ICIPE	International Centre For Physiology and Ecology
ICRC	Industrial Crops Research Centre
ICRI	Industrial Crops Research Institute
ICT	Information Communication Technology
IS	Irrigation Schemes
IOTs	Internet of Things
IPM	Integrated Pest Management
IRaP	Improved Ratoon Production
IRRI	International Rice Research Institute
ITK	Indigenous Technical Knowledge
IWUA	Irrigation Water Users Association
KALRO	Kenya Agricultural Livestock Research Organization
KARI	Kenya Agricultural Research Institute
KCAA	Kenya Civil Aviation Authority
KCSAP	Kenya Climate Smart Agriculture Project
KEBS	Kenya Burea of Standards
KEPHIS	Kenya Plant Health Inspectorate Service
KES	Kenyan Shillings
KNTC	Kenya National Trading Corporation
LGB	Larger Grain Borer
LLC	Leaf Color Chart
MoALD	Ministry of Agriculture and Livestock Development
MRGM	Mwea Rice Growers Multi-purpose Society
NARIGP	National Agricultural and Rural Inclusive Growth Project
NRDS	National Rice Development Strategy II
NAVCDP	National Agricultural Value Chain Development Project
NEMA	National Environmental Management Authority

NGO	Non-Governmental Organization
NIA	National Irrigation Authority
NRI	Non ruminant Institute
PCPB	Pest Control Product Board
PDO	Project Development Objective
RIPP	Rice Promotion Programme
RMAPP	Rice Based Market Oriented Agriculture Promotion Project
SPAD	Soil Plant Analysis Development
SRI	System of Rice Intensification
SSNM	Site specific Nutrient Management
TIMPs	Technology, Innovation and management practices
TARI	Tanzania Agricultural Research Institute
UDP	Urea Deep Placement
VMGs	Vulnerable and Marginalized Groups
WSRC	Water Saving Rice Culture
YSB	Yellow Stem borer

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1.1 DEFINITION OF TERMS

Agripreneur: An established commercial agri-entrepreneur who will be mentored and coached by a business accelerator to deliver E-extension sustainably and provide digital data on TIMPS dissemination and adoption.

Technology: This is an output of a research process which is beneficial to the target clientele (mainly farmers for NAVCDP's case), can be commercialized and can be patented under intellectual property rights (IPR) arrangements. It consists of research outputs such as tools, equipment, genetic materials, breeds, farming and herding practices, gathering practices, laboratory techniques, models etc.

Management practice: This is a recommendation on a practice that is considered necessary for a technology to achieve its optimum output. It includes different agronomic practices (seeding rates, fertilizer application rates, spatial arrangements, planting period, land preparation and watering regimes), crop protection for crops and feed rations and disease control for livestock.

Innovation: This is a modification of an existing technology for an entirely different use from the original intended use. (e.g., fireless cooker modified to be used as a hatchery).

1.2 SUMMARY OF INVENTORY OF TIMPS IN THE RICE VALUE CHAIN

The inventory process identified **160** TIMPs comprising of **74** technologies **25** innovations and **61** Management practices distributed among the 14 sub-themes, as indicated in table 1.

Table 1: Summary of Rice TIMPs

Commodity/ value chain	Sub-Theme	Technologies	Innovations	Management Practices
Rice	Improved Rice varieties	29	0	0
Rice	Rice seed system	0	3	0
Rice	GAPs and Food Safety	1	0	2
Rice	Agronomic management practices	4	0	6
Rice	Soil fertility management	2	2	2
Rice	Water and irrigation management	1	0	1
Rice	Precision Agriculture	7	2	0
Rice	Rice Crop health	0	0	30
Rice	Weed Management	0	0	9
Rice	Harvesting and Postharvest management	10	0	0
Rice	Rice Nutrition and Value addition	9	18	0
Rice	Mechanization of Rice production activities	11	0	0
Rice	Rice Farming Business and marketing	0	0	6

Rice	Elements of Agricultural Policies	0	0	5
Total		**74**	**25**	**61**

1.3 SUMMARY OF STATUS OF TIMPS IN RICE VALUE CHAIN

The inventory process resulted in a total of **129** TIMPs that are ready for upscaling, **30** TIMPs that require validation and **1** TIMP that require further research in the sub-themes, as indicated in Table 2.

Table 2: Number of TIMPs ready for upscaling, require validation or further research

Commodity/ value chain	Sub-Theme	Ready for upscaling	Requires validation	Further Research
Rice	Improved Rice Varieties	29	0	0
Rice	Rice seed system	1	2	0
Rice	GAPs and Food Safety	2	0	1
Rice	Agronomic Management practice	10	0	0
Rice	Soil fertility Management	6	0	0
Rice	Water and Irrigation Management	2	0	0
Rice	Precision Agriculture	6	3	0
Rice	Rice Crop health	24	6	0
Rice	Weed Management	7	2	0
Rice	Harvesting and Postharvest management	9	1	0
Rice	Rice Value addition	17	10	0
Rice	Mechanization of Rice production activities	9	2	0
Rice	Rice Farming Business and Marketing	4	2	0
Rice	Elements of Agricultural Policies	3	2	0
Total		**129**	**30**	**1**

1.4 INVENTORY OF RICE TIMPS BY CATEGORY AND STATUS

Table 3: Inventory of Rice TIMPs by Category and Status

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
2.2 Improved Rice varieties	**2.2.1 Irrigated & lowland rainfed**		
	IR05N221 (Komboka)	Technology	Ready for upscaling
	08FAN10 (Mkombozi)	Technology	Ready for upscaling
	CSR36	Technology	Ready for upscaling
	TXD306 (SARO 5)	Technology	Ready for upscaling
	NIBAM 10 *(Pishori 217)*	Technology	Ready for upscaling

	NIBAM 11 *(Pishori 370)*	Technology	Ready for upscaling
	NIBAM 108 (IR2793-80-1)	Technology	Ready for upscaling
	NIBAM 109 ((BW196)	Technology	Ready for upscaling
	NIBAM 110 (ITA310)	Technology	Ready for upscaling
	KEH10004 (ARIZE 6444 Gold/ INH1001)	Technology	Ready for upscaling
	KEH10005 (ARIZE TEJ Gold/ INH 11001)	Technology	Ready for upscaling
	AFEXH004	Technology	Ready for upscaling
	AFEXH001	Technology	Ready for upscaling
	AT054	Technology	Ready for upscaling
	AH18002	Technology	Ready for upscaling
	AH18003	Technology	Ready for upscaling
	AH18004	Technology	Ready for upscaling
	AH18007	Technology	Ready for upscaling
	AH18009	Technology	Ready for upscaling
	AH19003	Technology	Ready for upscaling
	AH19006	Technology	Ready for upscaling
	AH19007	Technology	Ready for upscaling
	TRENASSE	Technology	Ready for upscaling
	SC 213	Technology	Ready for upscaling
	2.2.2 Upland rainfed		
	Dourado Precoce	Technology	Ready for upscaling
	NERICA 1	Technology	Ready for upscaling
	NERICA 4	Technology	Ready for upscaling
	NERICA 10	Technology	Ready for upscaling
	NERICA 11	Technology	Ready for upscaling
2.3 Rice seed system	2.3.1 Improved Farmer Saved Seed-System	Innovation	Requires validation
	2.3.2 Standard Seed system	Innovation	Requires validation
	2.3.3 Rice Formal Seed System	Innovation	Ready for upscaling
2.4 Good Agricultural Practices and Food Safety Management Systems	2.4.1 Good Agricultural Practices (GAP) for Rice	Management practice	Ready for upscaling
	2.4.2 Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for Rice Value Chain in Kenya	Management practice	Ready for upscaling
	2.4.3 Aflasafe KE01^{TM} for Upland and rainfed lowland rice	Technology	Requires validation
2.5 Agronomic Management practice	2.5.1 Timely and appropriate land preparation	Management practice	Ready for upscaling
	2.5.2 Rice variety selection	Management practice	Ready for upscaling
	2.5.3 Nursery establishment	Management practice	Ready for upscaling
	2.5.4 Transplanting	Management practice	Ready for up-scaling

	2.5.5 Direct seeded rice	Technology	Ready for upscaling
	2.5.6 Fertilizer application	Management practice	Ready for upscaling
	2.5.7 Timely harvesting	Management practice	Ready for upscaling
	2.5.8 System of Rice Intesification	Technology	Ready for upscaling
	2.5.9 Water saving rice culture (WSRC)	Technology	Ready for upscaling
	2.5.10 Improved ratoon production (IRAP)	Technology	Ready for upscaling
2.6 Soil fertility management	2.6.1 Integrated soil fertility management	Management practice	Ready for upscaling
	2.6.2 Soil testing	Management practice	Ready for upscaling
	2.6.3 Vermicomposting	Innovation	Ready for upscaling
	2.6.4 Urea Deep placement	Technology	Ready for upscaling
	2.6.5 Site specific Nutrient Management	Innovation	Ready for upscaling
	2.6.6 Sequential cropping	Technology	Ready for upscaling
2.7 Water and Irrigation Management	2.7.1 Continous Flooding	Management practice	Ready for upscaling
	2.7.2 Alternate Wetting and Drying	Technology	Ready for upscaling
2.8 Precision Agriculture	2.8.1 Drone technology for Remote Sensing in Surveillance of Pests and Disease	Technology	Requires validation
	2.8.2 Drone technology in pests and disease spraying of pesticides, fungicides and herbicides	Technology	Requires validation
	2.8.3 Leaf wetness sensor for rice diseases monitoring	Technology	Requires validation
	2.8.4 Rice crop Manager	Innovation	Ready for upscaling
	2.8.5 Portable weather station	Technology	Ready for upscaling
	2.8.6 Leaf color charts	Technology	Ready for upscaling
	2.8.7 SPAD chlorophyll-meter	Technology	Ready for upscaling
	2.8.8 The tensiometer	Technology	Ready for upscaling
	2.8.9 Bird scarer	Innovation	Ready for upscaling
2.9 Rice Crop Health	2.9.1 Integrated management of grasshopper (Othoptera:Acrididae) in upland rice culutres	Management practice	Ready for upscalling
	2.9. 2.Integrated management of Mole Crickets in upland rice cultures	Management practice	Ready for upscalling
	2.9.3 Integrated management of rice sucking bugs (*Aspari*a sp. *Stenocorus spp* and	Management practice	Ready for upscaling

	Mirperus spp)		
	2.9.4 Integrated management of green stink bugs (*Nezera viridula*)	Management practice	Ready for upscalling
	2.9.5Integrated management of Rice leaf folders (*Cnaphalocrocis medinalis, Guenee*)	Management practice	Ready for upscalling
	2.9.6 Integrated management of rice case worm (*Nymphula depunctalis*)	Management options	Ready for upscaling
	2.9.7 Integrated management of rice whorl maggot (*Hydrellia* spp.)	Management practice	Ready for upscaling
	2.9.8 Integrated management of Rice White Stem Borer (*Maliarpha seperatela)*	Management practice	Ready for upscaling
	2.9.9 Integrated management of Spotted Stem borer (*Chilo partellus*)	Management practice	Require validation
	2.9.10Integrated management rice gall midge (*Orseolia oryzae*) - (Wood mason)	Management practice	Require validation
	2.9.11 Integrated Management of Stalk eyed fly (*Diopsis thoracica*)	Management practice	Ready for upscalling
	2.9.12 Integrated Management of Rice aster leaf hopper (*Macrosteles fascifrons*)	Management practice	Ready for upscalling
	2.9.13 Integrated Management of Granivorous birds	Management practice	Require validation
	2.9.14 Integrated management of Red billed quelea, Quelea quelea migratory birds	Management practice	Require validation
	2.9.15Integrated management of Rodents in rice fields	Management practice	Ready for upscaling
	2.9.16Integrated management of Larger Grain Borer (*Prostephanus trucantus*) in rice storage	Management practice	Require validation
	2.9.17 Integrated Management of Red Flour Beetles (*Tribolium*	Management practice	Require validation

	castaneum) in rice storage		
	2.9.18 Integrated management of Angoumois grain moth (*Sitotroga cerealella*) in rice storage	Management practice	Ready for upscaling
	2.9.19 Integrated management of rice weevil (*Sitophilus oryzae*) in rice storage	Management practice	Ready for upscaling
	2.9.20 Integrated management of rice nematodes in rice fields	Management practice	Ready for upscaling
	2.9.21Integrated management of golden apple snails and slugs in rice	Management practice	Ready for upscaling
	2.9.22 Integrated Pest Management of fall army worm in rice fields	Management practice	Ready for upscaling
	2.9.23 Integrated Management of soil pests Cut worms for upland rice (*Agrotis spp*)	Management practice	Ready for upscaling
	2.9.24 Integrated management of leaf mining beetles *(Trichispa sericea*)	Management practice	Ready for upscaling
	2.9.25 Integrated management of False smut (*Ustilaginoidea virens*) in Rice	Management practice	Ready for upscaling
	2.9.26Integrated Management of Brown Spot (*Cochliobolus Miyabeanus*) in rice	Management practice	Ready for upscaling
	2.9.27Integrated Management of Rice Yellow Mottle Virus (RYMV) in Rice	Management practice	Ready for upscaling
	2.9.28Integrated Management of Rice blast (Magnaporthe oryzae)	Management practice	Ready for upscaling
	2.9.29Integrated Management of Bacterial blight (*Xanthomonas oryzae pv. oryzae*)	Management practice	Ready for upscaling
	2.9.30Integrated Management of Sheath blight (*Rhizoctonia solani*)	Management practice	Ready for upscaling
2.10 Weed Management	2.10.1 Integrated weed management (IWM) in upland and lowland rice	Management practice	Ready for upscaling

	2.10.2. Integrated management of parasitic weed (*Striga haemethica*) in upland rice	Management practice	Requires validation
	2.10.3 integrated management of water hyacinth (*Eichornia crasipes*)	Management practice	Requires validation
	2.10.4 Flooding for weed management in lowland rice	Management practice	Ready for upscaling
	2.10.5 Chemical (Herbicide) Weed Control in upland and lowland rice	Management practice	Ready for upscaling
	2.10.6 Solarisation bed for weed control in upland and lowland rice	Management practice	Ready for upscaling
	2.10.7 Mechanical weed control in upland and lowland rice	Management practice	Ready for upscaling
	2.10.8 Stale seed bed for Weed Control	Management practice	Ready for upscaling
	2.10.9 Crop rotation weed management in upland and lowland rice	Management practice	Ready for upscaling
2.11 Harvesting and Postharvesting	2.11.1 Maturity indices	Management practice	Ready for upscaling
	2.11.2 Tarpaulins for drying paddy rice	Technology	Ready for upscaling
	2.11.3 Motorized paddy rice threshers	Technology	Ready for upscaling
	2.11.4 Solar bubble dryer	Technology	Ready for upscaling
	2.11.5 Grain moisture meter	Technology	Ready for upscaling
	2.11.6 Subjective methods for moisture content estimation Biting the grain or pinching with fingers The 'salt method'	Management Practice	Ready for upscaling
	2.11.7 Winnowing	Technology	Ready for upscaling
	2.11.8 Hermetic storage bags Purdue improved crop storage (PICS) bags Agro-Z GrainPro	Technology	Ready for upscaling
	2.11.9 Metal silo	Technology	Ready for upscaling
	2.11.10 Improved parboiling machine	Technoloy	Requires validation
2.12 Nutrition and Value	2.12.1 Parboiled rice	Innovation	Requires validation
	2.12.2 Brown rice	Innovation	Ready for upscaling
	2.12.3 Popped rice	Innovation	Ready for upscaling

Addition	2.12.4 Germinated brown rice	Innovation	Ready for upscaling
	2.12.5 Fortified rice flour	Innovation	Requires validation
	2.12.6 Rice bran ugali	Innovation	Ready for upscaling
	2.12.7 Weaning food	Innovation	Ready for upscaling
	2.12.8 Whole rice cookies	Innovation	Ready for upscaling
	2.12.9 Rice crakies	Innovation	Ready for upscaling
	2.12.10 Rice cake	Innovation	Ready for upscaling
	2.12.11 Instant rice flour	Innovation	Requires validation
	2.12.12 Rice flour	Innovation	Ready for upscaling
	2.12.13 Rice bread	Innovation	Ready for upscaling
	2.12.14 Rice mandazi	Innovation	Ready for upscaling
	2.12.15 Parched rice	Innovation	Ready for upscaling
	2.12.16 Puffed rice	Innovation	Ready for upscaling
	2.12.17 Rice noodles	Innovation	Ready for upscaling
	2.12.18 Canned rice	Technology	Requires validation
	2.12.19 Flaked rice	Innovation	Ready for upscaling
	2.12.20 Rice bran oil	Technology	Requires validation
	2.12.21 Rice beer	Technology	Requires validation
	2.12.22 Rice straw bails	Technology	Ready for upscaling
	2.12.23 Rice straw baskets	Technology	Requires validation
	2.12.24 Rice straw pot	Technology	Requires validation
	2.12.25 Rice straw broom	Technology	Ready for upscaling
	2.12.26 Rice husk briquette	Technology	Requires validation
	2.12.27 Rice husk particle board	Technology	Requires validation
2.13 Mechanization of Rice production activities	2.13.1 A Power Tiller (walking tractor)	Technology	Ready for upscaling
	2.13.2 Rubber tracked crawler tracto	Technology	Ready for upscaling
	2.13.3 Upland ecology Disc and chain Harrows	Technology	Ready for upscaling
	2.13.4 Combined Chisel plough & Power Harrow	Technology	Ready for upscaling
	2.13.5 GPS Laser Levelling	Technology	Requires validation
	2.13.6 Walk behind multi row mechanical transplanters	Technology	Ready for upscaling
	2.13.7 Drum seeder – Direct Seeding rice (4, 6 or 8 row types)	Technology	Ready for upscaling
	2.13.8 Motorised (2-row) paddy field weeder	Technology	Ready for upscaling
	2.13.9 Motorized Backpack fertilizer Spreader	Technology	Requires validation
	2.13.10 Mini Rice Mills	Technology	Ready for upscaling
	2.13.11 Rice Combine Harvester	Technology	Ready for upscaling

2.14 Rice Farming Business and marketing	2.14.1 Transformative production model	Management practice	Ready for upscaling
	2.14.2 Building a business plan	Management practice	Ready for upscaling
	2.14.3 Marketing as a group – collective marketing	Management practice	Ready for upscaling
	2.14.4 Profitability analysis – performance of Rice agro-enterprise	Management practice	Ready for upscaling
	2.14.5 Contracted production model	Management practice	Requires validation;
	2.14.6 Digital marketing	Management practice	Requires validation;
2.15 Elements of Agricultural Policies	2.15.1. National Rice Development Strategy II	Management practice	Ready for upscaling
	2.15.2 Policy options and objectives related to Rice farming	Management practice	Ready for upscaling
	2.15.3 Instruments of policy related to Rice	Management practice	Ready for upscaling
	2.15.4 Policy cycle for policy issues and implementation	Management practice	Ready for upscaling
	2.14.5 Policy validation cycle for policy customization	Management practice	Ready for upscaling

2 DETAILED RICE VALUE CHAIN TIMPS

2.1 SUITABILITY MAPS FOR RICE PRODUCTION IN KENYA

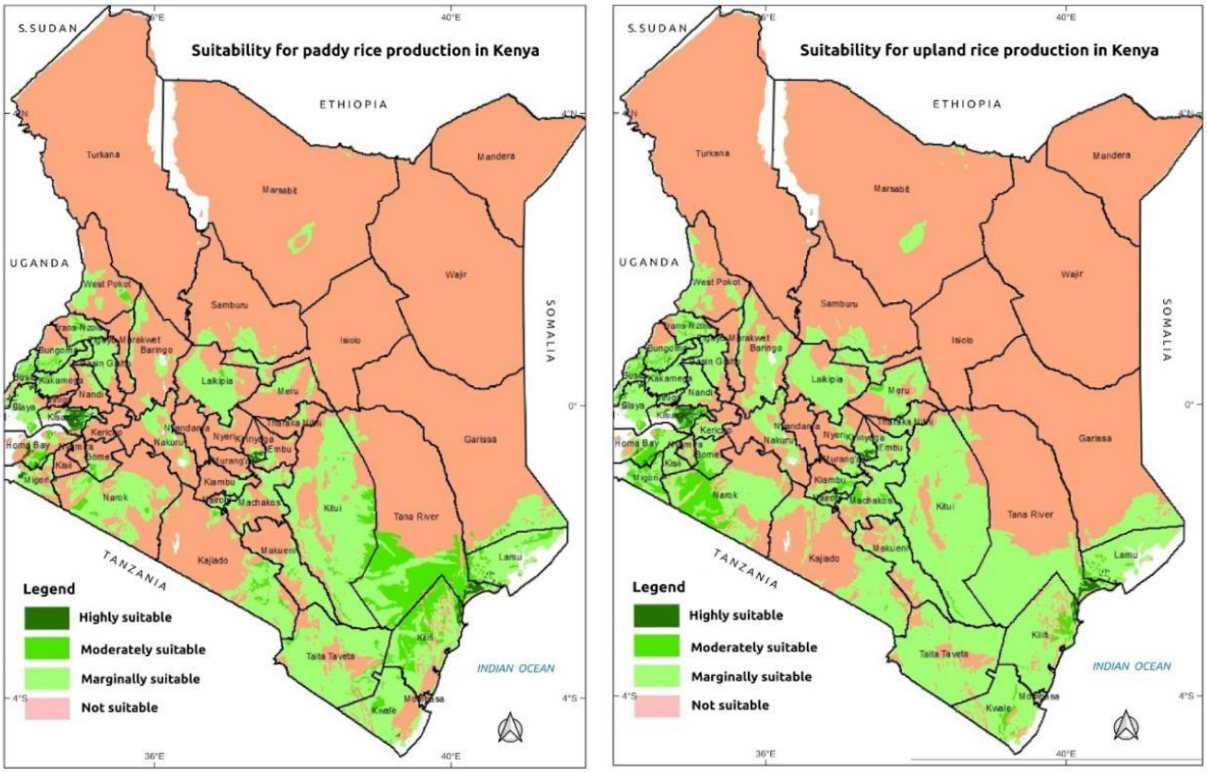


Figure 1: Suitability maps for paddy and upland rice in Kenya

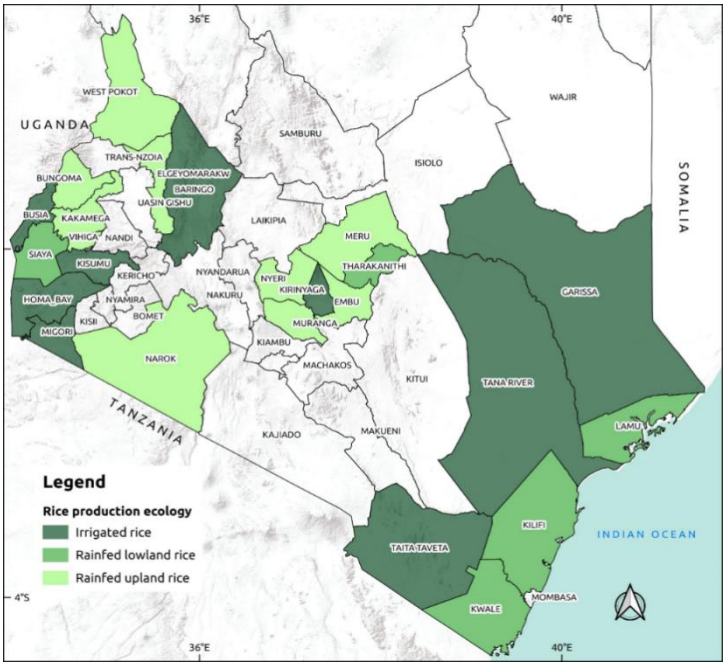


Figure 2: Rice production ecologies distributed in the 24 counties suitable for rice production in Kenya

2.2 IMPROVED RICE VARIETIES

2.2.1 Irrigated and Rainfed lowland

Rice variety IR05N221 (Komboka)

2.2.1.1. TIMP Name	**Rice variety IR05N221 (Komboka)**
	 *Komboka rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, poor grain quality, late maturity, susceptibility to water stress and diseases
What is it? (TIMP description)	*Komboka* is a pure line with a yield potential of 2.4 to 2.8 tonnes per acre. The variety is semi-aromatic and tasty with good grain and milling quality. It is of medium maturity (110 -120 days) and shows moderate tolerance to drought, rice blast and Rice Yellow Mottle Virus (RYMV). It has good ratoonability and is suitable for cultivation in irrigated and rainfed lowland ecologies.
Justification	The majority of the rice varieties under cultivation by small-scale farmers are unimproved and have low yields ranging from 1.2 to 2 tonnes per acre. Being an improved, high yielding, semi-aromatic, with good taste and milling quality, IR05N221 has acceptable consumer preference which makes it important for rice production in Kenya. Moreover the variety is climate smart in that it shows moderate tolerance to drought and has moderate resistance to rice blast and rice yellow mottle virus. Its ability to yield a good ratoon crop allows farmers to significantly increase their profits.The variety can help bridge the gap between local production of 300,000 metric tonnes per year, against consumption demand of 850,000 metric tonnes per year.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Seed merchants, Researchers, Agriculture service providers, Traders and Agripreneurs

Approaches to be used in dissemination	• On-farm and on-station research trials and demonstrations • Policy briefs, progress reports, press release • Conferences, workshops and meetings including public barazas, professional associations, agricultural fairs • Communication of outputs to farmer groups and stakeholders • Digital platforms and mass Media • Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services, • Promotional materials (posters, flyers, guides, DVDs, brochures, leaflets and manuals) • Farmer Field and Business Schools and farmer training
Critical/essential factors for successful promotion	• Robust seed system to support adoption, which enables access to breeder seeds for multiplication and distribution • Adopt strategic communication channels and training • Enabling agricultural policies • Participatory on-farm demonstrations by stakeholders • Collaboration among research, partners and regulatory institutions (KALRO, IRRI, MoALD, KEPHIS, County Governments) • Good marketing models and pathways
Partners/stakeholders for scaling up and their roles	• KALRO, IRRI and KEPHIS-To enable access to quality seed • Seed merchants for seed production and distribution • Agrodealers to avail seeds and inputs to farmers • Mechanization units and entrepreneurs to provide land preparation, planting, weeding services and combined harvesters • Agricultural extension services providers for backstopping in dissemination and production • Financial institutions- for credits
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMP will be upscaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta, Kwale
Challenges in dissemination	• Lack of data and information for sharing with wider audience to maximize benefits of research • Lack of rice innovation platforms and fora for stakeholders engagements • Cultural, language and gender barriers • The use of poorly packed dissemination pathways • Low technical capacity for farmers and extension providers

Suggestions for addressing the challenges	• KALRO and partners to gather/ collect data and information • Formation of rice innovation platforms for farmers, national and county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them • Develop easy-to-understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available
Lessons learned in upscaling if any	• High success in scaling/adoption is achieved when value chain stakeholders collaborate and work together • Demonstrations, agricultural shows and field days are powerful tools for awareness creation necessary for outscaling • Certified seed availability and accessibility and other inputs in a sustainable manner are crucial in upscaling • Availability of off-take markets is a key driver for adoption of the technology • Availability of resources (finances, facilities, personnel, time) for promotion is important for technology upscaling
Social, environmental, policy and market conditions necessary for development and upscaling	• Variety IR05N221 (Komboka) is produced in both irrigated and rainfed lowland ecologies and thus uses otherwise unfavourable lowlands for other crops • The acceptable yields and desirable market traits make it popular • There is a need to organize value chain players into a forum or platform for easy engagement and policy formulation/reviews in light of emerging scenarios • Aflatoxin contamination needs to be investigated for food safety mitigation measures • Most of the activities are gender-based thus the need for customization of gender issues for fairness and equity
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 77,831 per acre
Estimated returns	KES 200,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision-making processes because they are the household and therefore own the rice fields • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to income • Due to the triple role of women, they have limited participation in training and dissemination fora

	• Men attend most of the trainings, yet most farm work is carried out by women and youth • Women and youth perform most of the transplanting and weeding activities hence there is a need to develop gender-responsive transplanting and weeding tools • Men perform most of the land preparation, threshing and milling activities
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exist for women in marketing the produce • Opportunities exist for youth in the transportation of produce to stores and markets • Opportunities exist fo youth in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation • VMGs have less access to agricultural information, technology and knowledge • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to education, training and extension services • Due to their social status, VMGs are often excluded from decision-making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exist for VMGs in marketing the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• IR05N221 (Komboka) has been widely adopted recently due to vigorous promotion through demonstrations, field days, agricultural shows, mass and social media avenues • Good grain quality, high yield and good milling qualities have led to high commercialization or adoption of the variety
Application guidelines for users	1. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook 2. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/
F: Status of TIMP readiness (1-ready for upscaling, 2-requires validation; 3-requires further research**)**	1- ready for upscaling
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org.

	2. Institute Director, ICRI- Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea & Mtwapa; Dr. Ruth Musila; Dr. John Kimani
Partner organizations	KALRO, KEPHIS, NIA, National & County Governments, Cooperatives

Rice Variety 08FAN10 (Mkombozi)

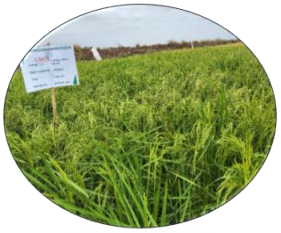
TIMP Name	**Rice variety 08FAN10 (Mkombozi)**
	   *Mkombozi rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, poor grain quality, late maturity and susceptibility to diseases
What is it? (TIMP description)	*Mkombozi* is a pure line with a yield potential of 2 to 2.4 tonnes per acre. The variety has a good taste with good grain and milling quality. It is of early maturity (95 – 115 days) and shows moderate resistance to blast. It has good ratoonability and is suitable for cultivation in the irrigated and rainfed lowland ecologies.
Justification	Majority of the rice varieties under cultivation by small sacle farmers are unimproved and have low yields ranging from 1.2 to 2 tonnes per acre. In addition, except for pishori varieties, majority of the varieties are not preferred by consumers. Being an improved high yielding, with good taste, grain and milling quality and acceptable consumer preference makes *Mkombozi* a good bet for production for the mass market in Kenya thus good substitute for the imports. It can help bridge the gap between local production (300,000 metric tonnes year) and consumption demand of 850,000 metric tonnes year) by replacing the low yielding unimproved varieties. Moreover the variety is climate smart in that it is early maturing showing drought avoidance and has moderate resistance to rice blast. It does well under both irrigated and rainfed lowland ecologies where other varieties may not be suitable. Its ability to yield a good ratoon crop allows farmers to significantly increase their profits.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Seed merchants, Researchers, Agriculture service providers, Traders and Agripreneurs
Approaches to be used in dissemination	• On-farm and on-station research trials and demonstrations • Policy briefs, progress reports, press release

	• Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Communication of outputs to groups and stakeholders • Mass Media and digital platforms • Use of already existing communication channels for farmers instead of creating new ones • Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services, • Promotional materials (posters, flyers, guides, DVDs, brochures, leaflets and manuals), • Farmer Field and Business Schools
Critical/essential factors for successful promotion	• Communication and training about the technology • Have strategic focus, farmers who are organized and willing to adopt, timely operations, good marketing strategy and finances plus other resources • Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers' cooperatives or financial institutions • Collaboration among research, partners and regulatory institutions (KALRO, IRRI, MoALD, KEPHIS, County Governments) • Good marketing models and pathways
Partners/stakeholders for scaling up and their role	• KALRO, IRRI and KEPHIS- access to quality seed • Seed merchants- seed production and distribution • Agro-dealers to avail seeds and inputs to farmers • Mechanization units and entrepreneurs- to provide land preparation, planting, weeding services and combine harvesters • Agricultural extension services providers for backstopping in dissemination and production • Financial institutions- credit disbursement
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta and Tana River
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with a wider audience to maximize benefits of research • Lack of rice innovation platforms and fora for stakeholder engagement • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• KALRO and partners to gather/ collect data and information • Formation of rice innovation platforms for farmers, national and county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches

	• Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them • Develop easy to understand information packages for farmers • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available
Lessons learned in upscaling if any	• High success in scaling/adoption is achieved when value chain stakeholders collaborate and work together • Demonstrations, agricultural shows and field days are powerful tools for awareness creation necessary for outscaling • Certified seed availability and accessibility and other inputs in a sustainable manner are crucial in TIMPs upscaling • Availability of off-take markets is a key driver for adoption of a technology • Availability of resources (finances, facilities, personnel, time) for promotion are important for technology upscaling
Social, environmental, policy and market conditions necessary for development and upscaling	• Mkombozi Variety is produced in both irrigated and rainfed lowland ecologies and thus makes use of otherwise unfavourable lowlands for other crops • The acceptable yields and desirable market traits make it popular • There is need to organize value chain players into a forum or platform for easy engagement and policy formulation/reviews in light of emerging scenarios • Aflatoxin contamination needs to be investigated for food safety mitigation measures • Most of the activities are gender-based thus need for customization of gender issues for fairness and equity
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 77,831 per acre
Estimated returns	KES 170,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household leaders and therefore own the rice fields • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youth are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination fora • Men tend to attend most of the trainings, yet most farm work are carried out by women and youth • Women and female youth perform most of the transplanting and weeding activities hence there is need to come up with gender-responsive transplanting and weeding tools • Men perform most of the land preparation, threshing and milling activities

Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required financial credit • Opportunities exist for women in the marketing the produce. • Opportunities for youth exist in the transportation of produce to the stores and the market • Opportunities exist for women and youth to earn income transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation • VMGs have less access to agricultural information, technology and knowledge • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exists for VMGs especially in marketing the produce • Affirmative action opportunities exist for VMGs to acquire the required financial credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	• Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M. and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook • Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/
F: Status of TIMP readiness (1-ready for upscaling;, 2- requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	1. Centre Director, KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Institute Director, KALRO Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea & Mtwapa; Dr. Ruth Musila; Dr. John Kimani
Partner organizations	KALRO, IRRI, KEPHIS, NIA, National & County Governments, Cooperatives

Rice variety CSR36

TIMP Name	Rice variety CSR36
	  *CSR36 rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, poor grain quality, late maturity, salinity-sodic toxicity and susceptibility to diseases, high imports
What is it? (TIMP description)	CSR36 is a pure line tolerant to salinity with yield potential of 2 to 2.2 tonnes per acre under saline conditions and upto 2.6 tonnes per acre under normal conditions . It grows under saline-sodic soils (that is soils with pH levels more than 8.5) and can tolerant high pH stress of up to 9.6–9.8, and salt stress or saline soils of electrical conductivity (ECe) 6-10 dS / m (saline). The optimum pH range for rice production is 5.5 to 6.5. It matures within 120 to 125 days after sowing. It is aromatic with long grain grains and good cooking quality. It has good ratoonability and is suitable for cultivation in the irrigated and rainfed lowland ecologies.
Justification	Majority of the rice varieties under cultivation by small sacle farmers are unimproved and have low yields ranging from 1.2 to 2 tonnes per acre and are not suitable for the salt affected areas especially in the coastal regions of Kenya. In addition, except for pishori varieties, majority of the varieties are not preferred by consumers. Being an improved high yielding, saline tolerant, aromatic, with good taste, grain and milling quality and acceptable consumer preference makes CSR36 a good bet for production for the mass market in Kenya thus good substitute for the imports. It can help bridge the gap between local production (300,000 metric tonnes per year) and consumption demand of 850,000 metric tonnes per year) by replacing the low yielding unimproved varieties. Moreover the variety is climate smart in that it shows tolerance to salinity and therefore adapted well to salt affected irrigated and rainfed lowland ecologies, where other varieties may not be suitable. Its ability to yield a good ratoon crop allows farmers to significantly increase their profits.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Processors, Seed merchants, Researchers, Agriculture service providers, Traders and Agripreneurs
Approaches to be used in dissemination	• On-farm and on-station research trials and demonstrations

	• Conferences, workshops, meetings including public barazas, professional associations and agricultural fairs • Communication of outputs to groups and stakeholders • Digital platforms and mass media • Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services, • Promotional materials (posters, flyers, guides, brochures, leaflets and manuals), • Farmer Field and Business Schools and farmer training
Critical/essential factors for successful promotion	• Participatory on-farm demonstrations by stakeholders • Collaboration among research, partners and regulatory institutions (KALRO, IRRI, MoALD, KEPHIS, County Governments) for capacity building and promotion • Good marketing models and pathways • Develop promotional materials
Partners/stakeholders for scaling up and their role	• KALRO, IRRI and KEPHIS for access to quality seed • Seed merchants for seed production and distribution • Agrodealers to avail seeds and inputs to farmers • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combine harvesters • Agricultural extension services providers for backstopping in dissemination and production • Financial institutions- avail credit to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta and Tana River
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with a wider audience to maximize benefit of research • Lack of rice innovation platforms and fora foengagement • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers.
Suggestions for addressing the challenges	• KALRO and partners to gather/ collect data and information. • Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches. • Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them. • Develop easy to understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available.
Lessons learned in upscaling if any	• High success in scaling/adoption is achieved when value chain stakeholders collaborate and work together

	• Demonstrations, agricultural shows and field days are powerful tools for awareness creation necessary for outscaling • Certified seed availability and accessibility and other inputs in a sustainable manner are crucial in TIMPs upscaling • Availability of off-take markets is a key driver for the adoption of a technology • Availability of resources (finances, facilities, personnel, time) for promotion is important for technology upscaling
Social, environmental, policy and market conditions necessary for development and upscaling	• Variety CSR36 is produced in both irrigated and rainfed lowland ecologies and thus makes use of otherwise unfavourable lowlands for other crops. • The acceptable yields and desirable market traits make it popular. • There is need to organize value chain players into a forum or platform for easy engagement and policy formulation/reviews in right of emerging scenerios. • Aflatoxin contamination need to be investigated for food safety mitigation measure. • Most of activities are gender based thus need for customerization of gender issues for fairness and equity.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 77,831 per acre
Estimated returns	KES 170,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields • Women and youth have less access to land which limits them from fully adopting the enterprise. • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital. • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income. • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination fora. • Women perform most of the transplanting and weeding activities hence there is need to come up with gender responsive transplanting and weeding tools.
Gender related opportunities	• Opportunities for generating income for youth exist in transportation of the produce to the stores and the market. • Opportunities exist for women and youth in transplanting and weeding.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services.

	• Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exist for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	1. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook 2. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 3. https://www.irri.org/news-and-events/news/salinity-tolerant-rice-variety-set-boost-rice-yield-stress-prone-areas-kenya
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	1. Centre Director, KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org, 2. Institute Director, Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea & Mtwapa; Dr. Ruth Musila; Dr. John Kimani
Partner organizations	KALRO, IRRI, KEPHIS, NIA, National & County Governments, Cooperatives

Rice variety TXD306 (SARO5)

TIMP Name	**Rice variety TXD306 (SARO5)**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, poor grain quality, non-aromatic and susceptibility to diseases

What is it? (TIMP description)	TXD306 (SARO5) is awnless, high tillering and high yielding variety, producing 57-69 bags of 50 kg bags per acre^{-} It is moderately tolerant to rice blast and Rice Yellow Mottle Virus (RYMV), sheath rot and with good grain quality and with moderate aroma. It is early maturing 110-120 days, medium plant height 100-120 cm and easy to thresh compared to NERICA 4.
Justification	The majority of farmers' cultivars (about 70%) are low yielding (Less than 20 bags of 50 kg bags per acre) and susceptible to diseases like blast, RYMV, bacterial leaf blight (BLB), Brown Spot (BS) and non-aromatic with poor grain quality. TXD306 being high yielding with good grain quality and moderate resistance to RYMV and blast can help bridge the gap between local production (300,000 mt year^{-1}) and consumption demand of 850,000 mt year^{-1}) by replacing the low yielding (less than 8 bags of 50 kg per acre) landraces that are susceptible to diseases.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Seed merchants, Researchers, Agriculture service providers, Traders, Agripreneurs
Approaches to be used in dissemination	• On-farm and on-station research trials and demonstrations • Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Communication of outputs to groups and stakeholders • Digital platforms and Mass Media • Use of already existing communication channels for farmers instead of creating new ones • Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services • Promotional materials (posters, flyers, guides, brochures, leaflets and manuals) • Farmer Field and Business Schools and farmer training
Critical/essential factors for successful promotion	• Robust seed system to enhance access to breeder seeds for multiplication • Collaboration among research and regulatory institutions (KALRO, TARI, IRRI, MoALD, KEPHIS, ASA, TOSCI) for promotion and capacity building • Good marketing models and pathways
Partners/stakeholders for scaling up and their roles	• KALRO, TARI, TOSCI and KEPHIS- access to breeders seed • Seed merchants- seed production and distribution • Agrodealers- to avail seeds and inputs to farmers • Mechanization units, entrepreneurs to provide land preparation services, combined harvestors • Agricultural extension services- provide backstopping for dissemination and production • Financial institutions- provision of credit
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta, Kwale

Challenges in dissemination	• Lack of breeder seeds has curtailed the dissemination of information to wider audience • Lack of rice innovation platforms for stakeholder engagement. • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers. • Lack of monitoring and evaluation to determine issues that may hinder dissemination
Suggestions for addressing the challenges	• KALRO and TARI to work together towards breeder seeds acquisition and maintenance • Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them • Early stakeholders engagement during research design, discussions before onset of proposed research with those who will be affected by research output or products • Develop easy to understand information packages for farmers • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available • Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• Variety TXD306 its production is both irrigated and rainfed lowland ecology and has acceptable yields, desirable market traits • There is need to organize value chain players into a fora for easy engagement and dissemination of information and other essentials
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 77,831 per acre
Estimated returns	KES 200,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is need to come up with gender responsive transplanting and weeding tools.

Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit. • Opportunities exists for women in the marketing the produce. • Opportunities for youth males exists in transportation of the produce to the stores and the market. • Opportunities exist for women and female youth in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to education, training and extension services due tho their social status • Due to their social status VMGs are often excluded from decision-making in development and dissemination activities
VMG related opportunities	• Opportunities exists for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	1. Msomba et al., 2004. TXD306- a high-yielding and medium-maturing aromatic rice for the rainfed lowland and irrigated ecosystems in Tanzania. *International Rice Research Notes*, 29(1), 30–31. https://doi.org/10.5281/zenodo.6822834 2. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 3. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	3- Require further research
G. Contacts	
Contacts	1. Centre Director, KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Institute Director, KALRO-ICRI-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea & Mtwapa; Dr. Ruth Musila; Dr. John Kimani
Partner organizations	TARI, KEPHIS, NIA, National & County Governments, Cooperatives

Rice variety NIBAM10 (*Pishori 217*)

TIMP Name	**Rice variety NIBAM10 (*Pishori 217*)**
	 *Pishori 217 rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, poor grain quality, late maturity and susceptibility to diseases and pests
What is it? (TIMP description)	It is awned, moderate yielding variety, potentially producing above 28 bags of 50 kg bags per acre. NIBAM10 is romatic and with good grain quality. The milling quality is moderate (about 65% head rice recovery-HRR) and tolerant to Rice yellow mottle virus (RYMV) and high ratoonability
Justification	NIBAM10 although has moderate yields, it has very high and desirable market and consumer traits. It is therefore consumed pure or used to blend other varieties with high yield, similar grain characteristics but lacking aroma thus fetching higher price leading to improved socio-economic wellbeing of the value chain players.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Traders, Seed merchants, Researchers, Agriculture Service Providers and Agripreneurs
Approaches to be used in dissemination	• Public and private agricultural extension services • Digital platforms, Mass Media • On-farm and on-station research trials and demonstrations • Farmer Field and Business Schools • Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Communication of outputs to groups and stakeholders • Use of already existing communication channels for farmers instead of creating new ones • Agricultural shows, exhibitions and innovation fora and platforms • Promotional materials (posters, flyers, guides, brochures, leaflets and manuals)
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Good environmental factors devoid of undesired disruptions • Good agricultural policies • Communication and training about the technology • Have strategic focus, farmers who are organized and willing to adopt, timely operations, good marketing strategy and finances plus other resources

	• Good marketing architecture pathways coupled with prompt payments • Participatory on-farm demonstrations by stakeholders • Collaboration among research, partners and regulatory institutions (KALRO, NIA, IRRI, MoALD, KEPHIS, County Governments) • Development of robust emerging destructive golden apple snails
Partners/stakeholders for scaling up and their roles	• KALRO, NIA, IRRI, Universities and KEPHIS for access to quality seed • Seed merchants for seed production and distribution • Agricultural extension services providers for backstopping in dissemination and production • Agrodealers to avail seeds and inputs to farmers • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combine harvesters • Financial institutions for credits • Processors especially millers and government institutions for uptake of produce
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Tana River, Kisumu, Busia, Taita Taveta, Busia
Counties where TIMP will be upscaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta, Kwale
Challenges in dissemination	• Lack of data and information for sharing with wider audience to maximize benefit of research e.g. information on golden apple snail. • Lack of effective rice innovation platforms and fora for stakeholders engagements. • Cultural, language and gender barriers • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers.
Suggestions for addressing the challenges	• NIA, KALRO and partners to gather/ collect necessary data and information • Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Anticipate likely barriers to dissemination and address them • Involve partners and County Governments in dissemination • Early stakeholders engagement during research design, discussions before onset of proposed research with those who will be affected by research output or products • Develop information materials suitable for farmers with disabilities • Develop easy to understand information packages for farmers.

	• Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available • Community or target audience mobilization and clarification of any issues they may have, may involve study tours, exchange • Implementation of new ICT tools, research outputs focusing on the desired end-point and engaging those in the community (influencers) whose support is required for benefits accrue
Lessons learned in upscaling if any	• Availability of off-take markets is a key driver for the adoption of a technology • High success in scaling/adoption is achieved when value chain stakeholders collaborate and work together • Demonstrations, agricultural shows and field days are powerful tools for awareness creation necessary for outscaling • Certified seed availability and accessibility and other inputs in a sustainable manner are crucial in TIMPs upscaling • Availability of resources (finances, facilities, personnel, time) for promotion is important for technology upscaling
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable yields and desirable market traits are necessary conditions for widespread upscaling • Variety NIBAM10 is produced in both irrigated and rainfed lowland ecologies and thus makes use of otherwise unfavourable flooded lowlands for other crops • Organized value chain players into a forum or platform for easy engagement and policy formulation/reviews allow handling of emerging scenarios • Aflatoxin contamination needs to be investigated for food safety mitigation measures • Most activities are gender-based thus need for customization of gender issues for fairness and equity
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 75,636 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise. • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital. • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income. • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums. • Women and female youth perform most of the transplanting and weeding activities, hence there is need to develop gender-responsive transplanting and weeding tools.
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required financial credit. • Opportunities exist for women in marketing the produce.

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.
VMG related opportunities	• Opportunities exists for VMGs in marketing of the produce. • Affirmative action opportunities exist for VMGs to acquire the required financial credit.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• NIBAM10 has been widely adopted due to promotion through demonstrations, field days, agricultural shows, mass and social media avenues • Good grain quality, high yield and good milling qualities have led to high commercialization or adoption of the variety
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (; 2- requires validation; 3- requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Officer in Charge, Mwea Irrigation Agricultural Development (MIAD) Centre; P. O. Box 210-10303. Wang'uru. Telephone. *110943932. Email.* miad@irrigation.go.ke General Manger, Mwea Rice Growers Multipurpose Co-Operative Society Ltd. Makutano/Embu Rd, Kerugoya, 38-10303 Wanguru, Wanguru, Kenya ; Phone Number. *+254-6048030* ; Fax. +254-6048030
Lead organization and scientists	National Irrigation Authority,
Partner organizations	NIA, MRGM, KALRO, KEPHIS, National & County Governments, Cooperatives

2.2.1.1 Rice variety NIBAM11

TIMP Name	Rice variety NIBAM 11 (*Pishori 370)*
	 *Pishori 370 rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, poor grain quality, late maturity and susceptibility to diseases and pests
What is it? (TIMP description)	NIBAM11 is awned, moderate in yields (less tha 32 bags of 50 kg per acre), aromatic and with good grain quality of indica type long slender and white. The milling quality is moderate (less than 65% head rice recovery-HRR) and tolerant to RYMV and high ratoonability. It grows in altitude 15-1700 masl and is early maturity (95-112 days)
Justification	NIBAM11 has moderate yields, which is higher than NIBAM10. It has desirable market and consumer characteristics. It's widely consumed in its pure form or used to blend other non-aromatic varieties with high yields and with similar grain characteristics.The blending imparts fragrance that allow the mixture to fetch higher price leading to improved socio-economic well-being of the value chain players
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Traders, Seed merchants, Researchers, Agriculture service providers and Apripreneurs
Approaches to be used in dissemination	• Promotional materials (posters, flyers, guides, DVDs, brochures, leaflets and manuals) • Digital platforms and mass Media • Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • On-farm and on-station research trials and demonstrations • Farmer Field and Business Schools • Agricultural shows, exhibitions and innovation fora and platforms • Digital Platforms (Website, Dashboards, Apps, social media short message services) and mass media
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Enabling agricultural policies • Good marketing architecture pathways coupled with prompt payments along the value chain • Collaboration among research, partners and regulatory institutions (NIA, KALRO, IRRI, MoALD, KEPHIS, Universities, NEMA, County Governments) in capacity building and promotion)

Partners/stakeholders for scaling up and their role	• NIA, KALRO, IRRI, NCPB, KNTC, Universities and KEPHIS - for access to quality seed • Agrodealers to avail seeds and inputs to farmers • Seed merchants- for seed production and distribution • Financial institutions- for credits • Agricultural extension services providers- for backstopping in dissemination and production • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combine harvesters • Processors especially millers and government institutions for uptake of produce
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Tana River, Kisumu, Busia, Taita Taveta and Busia
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with a wider audience to maximize benefits of research e.g. information on golden apple snail • Lack of effective rice innovation platforms and fora for stakeholder engagement • Unfavourable policies especially when dealing with mass media. • Cultural, language and gender barriers • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• NIA, KALRO and partners to gather/ collect necessary data and information. • Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches. • Create and formulate enabling policy environment for sustainable dissemination of TIMPs. • Anticipate likely barriers to dissemination and address them. • Involve partners and County Governments in dissemination. • Develop information materials suitable for farmers with disabilities. • Develop easy-to-understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available. • Community or target audience mobilization and clarification of any issues they may have, which may involve study tours, exchange

Lessons learned in upscaling if any	• Availability of off-take markets is a key driver for adoption of a technology • Demonstrations, agricultural shows and field days are powerful tools for awareness creation necessary for outscaling • High success in scaling/adoption is achieved when value chain stakeholders collaborate and work together • Certified seed availability and accessibility and other inputs in a sustainable manner are crucial in TIMPs upscaling • Availability of resources (finances, facilities, personnel, time) for promotion is important for technology upscaling
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable yields and desirable market traits are necessary conditions for widespread upscaling • Variety NIBAM11 is produced in both irrigated and rainfed lowland ecologies thus making efficient use of otherwise unfavourable flooded lowlands for other crops • Most of the activities are gender-based thus need for customization of gender issues for fairness and equity • Organized value chain players into a forum or platform for easy engagement and policy formulation/reviews to facilitate handling of emerging scenarios e.g. golden apple snail • Aflatoxin contamination needs to be investigated for food safety mitigation measure • Availability of machinery and other infrastructure like irrigation, milling, offtakers e.g. NCPB, KNTC contribute to upscaling
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 75,636 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise. • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital. • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income. • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums. • Women and female youth perform most of the transplanting and weeding activities hence there is need to come up with gender responsive transplanting and weeding tools.
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit. • Opportunities exist for women in the marketing the produce. • Opportunities for youth exist in transportation of the produce to the stores and the market. • Opportunities exist for women and youth in transplanting and weeding.

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision-making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	• Opportunities exist for VMGs in marketing of the produce. • Affirmative action opportunities exist for VMGs to acquire the required credit.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• NIBAM11 has been widely adopted due to promotion through demonstrations, field days, agricultural shows, mass and social media avenues • Good grain quality, high yield and good milling qualities have led to high commercialization or adoption of the variety
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	1. Officer in Charge, Mwea Irrigation Agricultural Development (MIAD) Centre; P. O. Box 210-10303. Wang'uru. *Telephone*. 110943932. *Email.* miad@irrigation.go.ke 2. General Manger, Mwea Rice Growers Multipurpose Co-Operative Society Ltd. Makutano/Embu Rd, Kerugoya, 38-10303 Wanguru, Wanguru, Kenya ; Phone Number. *+254-6048030* ; Fax. +254-6048030
Lead organization and scientists	National Irrigation Authority,
Partner organizations	NIA, MRGM, KALRO, KEPHIS, NCPB, KNTC, National & County Governments, Cooperatives

Rice variety NIBAM108

TIMP Name	**Rice variety NIBAM 108 (IR2793-80-1)**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, late maturity and susceptibility to diseases and pests
What is it? (TIMP description)	NIBAM108 is unawned, high-yielding variety (less than 49 bags of 50 kg per acre), medium maturity (135-145 days) with no anthocyanin. The rice variety is non-aromatic with long slender white grain. The milling quality is moderate (less than 65% head rice recovery-HRR) and tolerant to rice blast and high tillering.
Justification	NIBAM108 is high yielding, without aroma and has long slender white grains resembling NIBAM10 and 11, allowing it to blend with them to fetch a higher market price than pure grains. It is consumed in pure or as a blend. The high consumption (850,000 mt per ha) gap due to low local production (300,000 mt per ha) will be reduced through its production.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Processors, Traders, Seed merchants, Researchers, Agriculture service providers, Agripreneurs
Approaches to be used in dissemination	• Mass Media (Website, Dashboards, Apps, social media short message services) and digital platforms • Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services • Promotional materials (posters, flyers, guides, DVDs, brochures, leaflets and manuals), • On-farm and on-station research trials and demonstrations • Farmer Field and Business Schools • Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Communication of outputs to groups and stakeholders
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Good agricultural policies • Credit availability either from farmers cooperatives or financial institutions • Collaboration among research, partners and regulatory institutions (KALRO, NIA, IRRI, MoALD, NCPB, KNTC, KEPHIS, County Governments) in capacity building and promotion

Partners/stakeholders for scaling up and their role	• Seed merchants- for seed production and distribution • Financial institutions for credits • KALRO, NIA, IRRI, NCPB, KNTC, Universities and KEPHIS - for access to quality seed • Agricultural extension services providers- for backstopping in dissemination and production • Agrodealers to avail seeds and inputs to farmers • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combined harvestors • Processors especially millers and government institutions for uptake of produce
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Tana River, Kisumu, Busia, Taita Taveta and Busia
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with wider audience to maximize benefit of research e.g. information on golden apple snail. • Lack of effective rice innovation platforms and fora for stakeholders engagements. • Unfavourable policies especially when dealing with mass media. • Poorly packaged dissemination pathways • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• NIA, KALRO and partners to gather/ collect necessary data and information. • Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches. • Create and formulate enabling policy environment for sustainable dissemination of TIMPs. • Anticipate likely barriers to dissemination and address them. • Involve partners and County Governments in dissemination. • Early stakeholders engagement during research design, discussions before onset of proposed research with those who will be affected by research output or products. • Develop information materials suitable for farmers with disabilities. • Develop easy to understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available. • Community or target audience mobilization and clarification of any issues they may have, may involve study tours, exchange visits.

Lessons learned in upscaling if any	• Availability of off-take markets is a strong driver for adoption of a technology. • Demonstrations, agricultural shows and field days are powerful tools for awareness creation necessary for outscaling. • Availability of resources (finances, facilities, personnel, time) for promotion are important for technology upscaling. • High success in scaling/adoption is achieved when value chain stakeholders collaborate and work together. • Certified seed availability and accessibility and other inputs in a sustainable manner are crucial in TIMPs upscaling.
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable yields and desirable market traits are necessary condition for widespread upscaling • Organized value chain players into a forum or platform for easy engagement and policy formulation/reviews allow handling of emerging factors • Variety NIBAM108 is produced in both irrigated and rainfed lowland ecologies and thus makes use of otherwise unfavourable flooded lowlands for other crops • Aflatoxin contamination need to be investigated for food safty mitigation measure • Most of activities are gender based thus need for customerization of gender issues for fairness and equity
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 77,831 per acre
Estimated returns	KES 190,250 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise. • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital. • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income. • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums. • Women and female youth perform most of the transplanting and weeding activities hence there is need to come up with gender responsive transplanting and weeding tools.
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit. • Opportunities exists for women in the marketing the produce. • Opportunities for youth exists in transportation of the produce to the stores and the market. • Opportunities exist for women and youth in transplanting and weeding.

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exist for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• NIBAM108 has been widely adopted due to promotional demonstrations, field days, agricultural shows, mass and social media avenues • Good grain quality mimicking NIBAM10&11, high yield and good milling qualities have led to high commercialization or adoption of the variety
Application guidelines for users	• Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ • Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Officer in Charge, Mwea Irrigation Agricultural Development (MIAD) Centre; P. O. Box 210-10303. Wang'uru. Telephone: *110943932. Email.* miad@irrigation.go.ke General Manger, Mwea Rice Growers Multipurpose Co-Operative Society Ltd. Makutano/Embu Rd, Kerugoya, 38-10303 Wanguru, Wanguru, Kenya ; Phone Number. *+254-6048030* ; Fax. +254-6048030
Lead organization and scientists	National Irrigation Authority,
Partner organizations	NIA, MRGM, KALRO, KEPHIS, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.2 Rice variety NIBAM109

TIMP Name	Rice variety NIBAM 109 (BW196)
	 ***NIBAM 109***
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields and susceptibility to diseases and pests
What is it? (TIMP description)	NIBAM109 is unawned but tiped, high yielding variety (less tha 64 bags of 50 kg per acre, non-aromatic with short thick grain. It is high tillering with moderate milling quality (less than 55% head rice recovery-HRR) and tolerant to rice blast. It is late maturing (135-150 days) with no anthocyanin.
Justification	The gap between local production (300,000 mt per ha) and the consumption (850,000 mt per ha) is big and NIBAM109 due to its excellent yields and blast resistant can help close this gap thus saving foreign exchange for use in other sectors of the economy.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Traders, Seed merchants, Researchers, Agriculture service providers and Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business schools • Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Digital platforms (Website, Dashboards, Apps, social media short message services)and Mass Media • Communication of outputs to groups and stakeholders • Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services • Promotional materials (posters, flyers, guides, brochures, leaflets and manuals), • On-farm and on-station research trials and demonstrations
Critical/essential factors for successful promotion	• Good and enabling agricultural policies • Robust seed system to support adoption • Collaboration among research, partners and regulatory institutions (KALRO, NIA, IRRI, MoALD, NCPB, KNTC, KEPHIS, County Governments) in capacity building and promotion • Participatory on-farm demonstrations by stakeholders
Partners/stakeholders for scaling up and their role	• KALRO, NIA, IRRI, NCPB, KNTC, Universities and KEPHIS for access to quality seed • Seed merchants for seed production and distribution • Financial institutions for credits

	• Mechanization units, entrepreneurs to provide land preparation, planting, weeding services and combine harvesters • Agricultural extension services providers for backstopping in dissemination and production • Agrodealers to avail seeds and inputs to farmers • Processors especially millers and government institutions for uptake of produce
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Tana River, Kisumu, Busia, Taita Taveta and Busia
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with wider audience to maximize benefit of research e.g. information on golden apple snail • Lack of effective rice innovation platforms and fora for stakeholders engagements • Unfavourable policies especially when dealing with mass media • Cultural, language and gender barriers • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• NIA, KALRO and partners to gather/ collect necessary data and information • Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Create and formulate enabling policy environment for sustainable dissemination of TIMPs • Anticipate likely barriers to dissemination and address them • Involve partners and County Governments in dissemination • Develop information materials suitable for farmers with disabilities • Develop easy to understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available • Community or target audience mobilization and clarification of any issues they may have, may involve study tours, exchang
Lessons learned in upscaling if any	• Planned comparisons, participatory on-farm trials, demonstrations, agricultural shows and field days are strong pathways for awareness creation necessary for widespread upscaling • Availability of off-take markets is a strong driver for adoption of a technology • Availability of resources (finances, facilities, personnel, time) for promotion are important for technology upscaling

	• High success in scaling/adoption is achieved when value chain stakeholders collaborate and work together • Certified seed availability and accessibility and other inputs in a sustainable manner are crucial in TIMPs upscaling • Bahavioural aspects of characteristics of community or individuals relating to attitude, knowledge and perception can either promote or demote scaling efforts
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable yields and desirable market traits are necessary condition for widespread upscaling if farmers perception is positive towards the variety • Variety NIBAM109 is produced in both irrigated and rainfed lowland ecologies and thus makes use of otherwise unfavourable flooded lowlands where other crops can't thrive hence becoming breeding ground for mosquitoes etc • Organized value chain players into a forum or platform for easy engagement and policy formulation/reviews allow handling of emerging factors as well as the forecasting of future trend • Absense of flatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most of activities are gender based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfairs.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 80,451
Estimated returns	KES 200,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is need to come up with gender responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exists in transportation of the produce to the stores and the market • Opportunities exist for women and youth in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers.

	• VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exists for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• NIBAM109 has been widely adopted by Mwea irrigation scheme (MIS) and out growers farmers due to promotional demonstrations, field days, agricultural shows, mass and social media avenues. It is high tillering and yielding with short plump grains that swell when cooked and has slow digestion compared to NIBAN10 and 11. • The milled and polished grains are used both as household food security and the broken grains for livestock feeding thus it has wide market..
Application guidelines for users	• Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ • Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Officer in Charge, Mwea Irrigation Agricultural Development (MIAD) Centre; P. O. Box 210-10303. Wang'uru. Telephone.110943932. Email. miad@irrigation.go.ke General Manger, Mwea Rice Growers Multipurpose Co-Operative Society Ltd. Makutano/Embu Rd, Kerugoya, 38-10303 Wanguru, Wanguru, Kenya ; Phone Number. +254-6048030 ; Fax. +254-6048030
Lead organization and scientists	National Irrigation Authority,
Partner organizations	NIA, MRGM, KALRO, KEPHIS, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.3 Rice variety NIBAM110

TIMP Name	Rice variety NIBAM 110 (ITA310)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, late maturity and susceptibility to diseases
What is it? (TIMP description)	NIBAM110 is unawned with tolerant to blast and RYMV. It is moderate yielding (less than 24 bags of 50 kg per acre), non-aromatic with long narrow grain. It is medium tillering with moderate milling quality (less than 65% head rice recovery-HRR) early maturing (110-120 days) with no anthocyanin colouration.
Justification	NIBAM110 is tolerant to both blast and RYMV and has the acceptable indica grain type that are long slender.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Processors, Traders, Seed merchants, Researchers, Agriculture service providers, Agripreneures
Approaches to be used in dissemination	• Farmer Field and Business Schools and farmer training • Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Mass Media (Website, Dashboards, Apps, social media short message services) and digital platforms • Communication of outputs to groups and stakeholders • Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services • Promotional materials (posters, flyers, guides, DVDs, brochures, leaflets and manuals) • On-farm and on-station research trials and demonstrations
Critical/essential factors for successful promotion	• Good and enabling agricultural policies • Robust seed system to support adoption • Collaboration among research, partners and regulatory institutions (KALRO, NIA, IRRI, MoALD, NCPB, KNTC, KEPHIS, County Governments) for capacity building and promotion. • Participatory on-farm demonstrations by stakeholders • Establish effective communication channels and training • Credit availability either from farmers' cooperatives or financial institutions
Partners/stakeholders for scaling up and their role	• KALRO, NIA, IRRI, MRGM, NCPB, KNTC, Universities and KEPHIS- for access to quality seed • Seed merchants- for seed production and distribution • Financial institutions- for credits • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combine harvesters • Agricultural extension services providers for backstopping in dissemination and production • Agrodealers to avail seeds and inputs to farmers • Processors especially millers and government institutions for uptake of produce

C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Tana River, Kisumu, Busia, Taita Taveta and Busia
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with wider audience to maximize benefit of research • Lack of rice innovation platforms and fora for stakeholders engagements • Cultural, language and gender barriers • Lack of attention, interest, distractions, or irrelevance to the receiver • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• KALRO and partners to gather/ collect data and information. • Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches. • Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them. • Early stakeholder engagement during research design, discussions before onset of proposed research with those who will be affected by research output or products. • Develop easy-to-understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available.
Lessons learned in upscaling if any	• Planned comparisons, participatory on-farm trials, demonstrations, agricultural shows and field days are strong pathways for awareness creation necessary for widespread upscaling. • Availability of off-take markets is a strong driver for adoption of technology. • Availability of resources (finances, facilities, personnel, time) for promotion is important for technology upscaling. • High success in scaling/adoption is achieved when value chain stakeholders collaborate and work together. • Certified seed availability and accessibility and other inputs in a sustainable manner are crucial in TIMPs upscaling. • Behavioural aspects of characteristics of a community or individuals relating to attitude, knowledge and perception can either promote or demote scaling efforts.
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable yields and desirable market traits are necessary condition for widespread upscaling if farmers perception is positive towards the variety. • Variety NIBAM110 is produced in both irrigated and rainfed lowland ecologies and thus makes use of otherwise unfavourable flooded lowlands where other crops can't thrive hence becoming breeding grounds for mosquitoes etc

	• Organized value chain players into a forum or platform for easy engagement and policy formulation/reviews allow handling of emerging factors as well as the forecasting of future trend • Absence of aflatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most of the activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfairs.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 75,636 per acre
Estimated returns	KES 170,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is need to develop gender-responsive transplanting and weeding tools • Men perform most of the land preparation, threshing and milling activities
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exists for women in the marketing the produce • Opportunities for youth exist in the transportation of the produce to the stores and the market • Opportunities exist for women and youth in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision-making in development and dissemination activitie
VMG related opportunities	• Opportunities exists for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• NIBAM110 has been adopted by Mwea irrigation scheme (MIS) and out growers farmers due to promotional demonstrations, field

	days, agricultural shows, mass and social media avenues. Its tillering is moderate and it is blended with NIBAM10 & 11 because the grains are similar • The milled and polished grains are used both as household food security and sold to market for revenue generation and thus improvement in socio-economic wellbeing of the value chain players
Appication guidelines for users	• Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ • Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Officer in Charge, Mwea Irrigation Agricultural Development (MIAD) Centre; P. O. Box 210-10303. Wang'uru. Telephone.110943932. Email. miad@irrigation.go.ke General Manger, Mwea Rice Growers Multipurpose Co-Operative Society Ltd. Makutano/Embu Rd, Kerugoya, 38-10303 Wanguru, Wanguru, Kenya ; Phone Number. +254-6048030 ; Fax. +254-6048030
Lead organization and scientists	National Irrigation Authority,
Partner organizations	NIA, MRGM, KALRO, KEPHIS, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.4 Rice variety KEH10004 (ARIZE 6444 Gold/ INH1001)

TIMP Name	**Rice variety KEH10004 (ARIZE 6444 Gold/ INH1001)**
Category (i.e. technology, innovation or management practice)	Technology  *ARIZE 6444 Gold Rice Variety*

A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, lodging and susceptibility to diseases
What is it? (TIMP description)	It is a hybrid variety, high yielding (less than 61 bags of 50 kg per acre), semi-aromatic, with medium slender grains. It is tolerant to blast, bacterial leaf blight and resistant to lodging with no chaffiness. It has good milling quality and it is medium-late maturing (135-145 days).
Justification	The gap between local production (300,000 mt $year^{-1}$) and the consumption (850,000 mt $year^{-1}$) is big and Arize 6444 Gold due to its excellent yields, BLB and blast tolerant can help close this gap thus saving foreign exchange for use in other sectors of the economy.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Processors, Traders, Seed merchants, Researchers, Agriculture service providers, consumers
Approaches to be used in dissemination	• Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services • Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Mass Media and digital platforms • Communication of outputs to groups and stakeholders • Farmer Field and Business Schools • Use of already existing communication channels for farmers instead of creating new ones • Promotional materials (posters, flyers, guides, brochures, leaflets and manuals), • Digital platforms • On-farm and on-station research trials and demonstrations
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers cooperatives or financial institutions • Good and enabling agricultural policies • Value addition of the low quality grains • Good marketing structure coupled with prompt payments systems • Collaboration among research, partners and regulatory institutions (KALRO, NIA, IRRI, MoALD, NCPB, KNTC, KEPHIS, County Governments) • Good environmental factors devoid of undesired disruptions • Communication and training about the technology • Have strategic focus, farmers who are organized and willing to adopt, timely operations, good marketing strategy and finances plus other resources • Education level as this determine or influences decision making • Irrigation facilities and mechanization • Development of robust emerging destructive golden apple snails

Partners/stakeholders for scaling up and their role	• Bayer, KALRO, NIA, NCPB, KNTC, Universities and KEPHIS for access to quality seed • Agricultural extension services providers for backstopping in dissemination and production • Processors especially millers and government institutions for uptake of produce Seed merchants for seed production and distribution • Financial institutions for credits • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combined harvestors • Agrodealers to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Busia, Taita Taveta,
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with wider audience to maximize benefit of research e.g. information on golden apple snail • Lack of effective rice innovation platforms and fora for stakeholders engagements • Unfavourable policies especially when dealing with mass media • Disseminations/communication barriers including physical barriers, perceptual barriers, emotional/taboos barriers, cultural barriers, language barriers, gender barriers, interpersonal/perceptions/ viewpoints barriers. • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Lack of attention, interest, distractions, or irrelevance to the receiver • Physical disabilities such as hearing, blindness problems or speech difficulties • Use of jargon or poorly packed information not ready for use by farmers and partners • Low technical capacity for farmers and extension providers • Language barrier – scientific language not easy to understand for non-scientists and results may be available in non-local language • Unavailability of communication, influencer experts to contextualize results into end-user understanding
Suggestions for addressing the challenges	• Partners to gather/ collect necessary data and information • Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Create and formulate enabling policy environment for sustainable dissemination of TIMPs • Anticipate likely barriers to dissemination and address them • Involve partners and County Governments in dissemination

	• Early stakeholders engagement during research design, discussions before onset of proposed research with those who will be affected by research output or products • Develop information materials suitable for farmers with disabilities • Develop easy to understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available • Community or target audience mobilization and clarification of any issues they may have, may involve study tours, exchange • Implementation of new ICT tools, research outputs focusing on the desired end-point and engaging those in the community (influencers) whose support is required for benefits accrue
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable yields and desirable market traits are conditions that lead to adoption and thus upscaling. The Arize 6444 Gold is tolerant to blast and BLB thus leading to less use of chemicals and lack of chaffiness lead to less air pollution by dust. • The high yield, medium slender grains coupled with good milling quality has positive influence in marketing. • Absense of flatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most of activities are gender based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 82,831 per acre
Estimated returns	KES 200,000/= $acre^{-1}$
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Men perform most of the land preparation, threshing and milling activities Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Men tend to attend most of the trainings, yet most farm work are carried out by women and youth. • Women and female youth perform most of the transplanting and weeding activities hence there is need to come up with gender responsive transplanting and weeding tools.

Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exists for women in the marketing the produce • Opportunities for youth males exists in transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.
VMG related opportunities	• Opportunities exists for VMGs especially the female youths in marketing of the produce • Opportunities for youths exists in transportation of the produce to the stores and the markets • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	• Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ • Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Ms. Alice Mwikali Timothy Company: Proseed Agriculture Limited, P.O Box 63498-00619 Muthaiga, Nairobi Kenya. Email: alice.timothy@proseedagriculture.com, support@proseedagriculture.com

	Proseed is licensed to market & sell Arize 6444 Gold & Arize Tej Gold in east Africa
Lead organization and scientists	Proseed Agriculture Limited, Ms. Alice Mwikali Timothy
Partner organizations	NIA, MRGM, KALRO, KEPHIS, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.5 Rice variety KEH10005 (ARIZE TEJ Gold/ INH 11001)

TIMP Name	**Rice variety KEH10005 (ARIZE TEJ Gold/ INH 11001)**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, lodging and susceptibility to diseases
What is it? (TIMP description)	It is a hybrid variety, high yielding (>57 bags of 50kg acre-1), semi-aromatic and with long slender grains. It is highly tolerant to bacterial leaf blight and moderately tolerant to blast. It is resistant to lodging with no chaffiness. Has good milling quality and it is early maturing (125-135 days).
Justification	The gap between local production (300,000 mt year^{-1}) and the consumption (850,000 mt year^{-1}) is big and Arize Tej Gold due to its excellent yields, BLB and blast tolerant can help abridge this gap thus saving foreign exchange for use in other sectors of the economy.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Traders, Seed merchants, Researchers, Agriculture service providers, consumers
Approaches to be used in dissemination	• Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services • Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Mass Media and Digital platforms • Communication of outputs to groups and stakeholders • Farmer field and business schools • Use of already existing communication channels for farmers instead of creating new ones • Promotional materials (posters, flyers, guides, brochures, leaflets and manuals), • On-farm and on-station research trials and demonstrations • Policy briefs, progress reports, press release

Critical/essential factors for successful promotion	• Participatory on-farm demonstrations by stakeholders • Good marketing structure coupled with prompt payments systems • Collaboration among research, partners and regulatory institutions (KALRO, NIA, IRRI, MoALD, NCPB, KNTC, KEPHIS, County Governments) • Good environmental factors devoid of undesired disruptions • Communication and training about the technology • Have strategic focus, farmers who are organized and willing to adopt, timely operations, good marketing strategy and finances plus other resources
Partners/stakeholders for scaling up and their role	• Bayer, KALRO, NIA, NCPB, KNTC, Universities and KEPHIS for access to quality seed • Agricultural extension services providers for backstopping in dissemination and production • Processors especially millers and government institutions for uptake of produce Seed merchants for seed production and distribution • Financial institutions for credits • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combined harvestors • Agrodealers to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Busia, Taita Taveta,
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of effective rice innovation platforms and fora for stakeholders engagements and deliberations • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Unfavourable policies especially when dealing with mass media • Language barrier – scientific language not easy to understand for non-scientists and results may be available in non-local language • Use of jargon or poorly packed information not ready for use by farmers and partners • Unavailability of communication, influencer experts to contextualize results into end-user understanding • Physical disabilities such as hearing, blindness problems or speech difficulties • Lack of data and information for sharing with wider audience to maximize benefit of research e.g. information on golden apple snail • Unavailability of communication, influencer experts to contextualize results into end-user understanding • Disseminations/communication barriers including physical barriers, perceptual barriers, emotional/taboos barriers, cultural

	barriers, language barriers, gender barriers, interpersonal/perceptions/ viewpoints barriers. • Lack of attention, interest, distractions, or irrelevance to the receiver
Suggestions for addressing the challenges	• Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Implementation of new ICT tools, research outputs focusing on the desired end-point and engaging those in the community (influencers) whose support is required for benefits accrue • Create and formulate enabling policy environment for sustainable dissemination of TIMPs • Recognize, appreciate and integrate multiple types of evidence for high dissemission results • Community or target audience mobilization and clarification of any issues they may have, may involve study tours, exchange • Early stakeholders engagement during research design, discussions before onset of proposed research with those who will be affected by research output or products • Bayer, NIA, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available • Embrace and adopt research designs, with practical or participatory approaches early • Establishing body of peer-reviewed literature to advice for translating science into evidence-based outcomes and practices that promote and improve clientel welfare in a sustainable manner • Anticipate likely barriers to dissemination and address them • Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable yields and desirable market traits are conditions that lead to adoption and thus upscaling. The Arize 6444 Gold is tolerant to blast and BLB thus leading to less use of chemicals and lack of chaffiness lead to less air pollution by dust. • The high yield, medium slender garains coupled with good milling quality has positive influence in marketing. • Absense of flatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most of activities are gender based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 82,831 per acre
Estimated returns	KES 212,250 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Men perform most of the land preparation, threshing and milling activities Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Men tend to attend most of the trainings, yet most farm work are carried out by women and youth. • Women and female youth perform most of the transplanting and weeding activities hence there is need to come up with gender responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exists for women in the marketing the produce • Opportunities for youth males exists in transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.
VMG related opportunities	• Opportunities exists for VMGs especially the female youths in marketing of the produce • Opportunities for youths exists in transportation of the produce to the stores and the markets • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	• Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/

	• Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Ms. Alice Mwikali Timothy Company: Proseed Agriculture Limited, P.O Box 63498-00619 Muthaiga, Nairobi Kenya. Email: alice.timothy@proseedagriculture.com, support@proseedagriculture.com Proseed is licensed to market & sell Arize 6444 Gold & Arize Tej Gold in east Africa
Lead organization and scientists	Proseed Agriculture Limited, Ms. Alice Mwikali Timothy
Partner organizations	NIA, MRGM, KALRO, KEPHIS, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.6 Rice variety AFEXH004

TIMP Name	**Rice variety AFEXH004**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, lodging and susceptibility to diseases
What is it? (TIMP description)	AFEXH004 is a high yielding variety (>73 bags of 50kg acre-1), aromatic (175ppb equivalent to NIBAM10 & 11) with long slender grains. It is extra early maturing taking 97 days.
Justification	The gap between local production (300,000 mt $year^{-1}$) and the consumption (850,000 mt $year^{-1}$) is huge and AFEXH004 due to its excellent yields and superior grain quality is a candidate to abridge this gap thus saving foreign exchange.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, consumers
Approaches to be used in dissemination	• Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services

	• Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Mass Media and digital platforms • Communication of outputs to groups and stakeholders • Farmer field and business schools • Use of already existing communication channels for farmers instead of creating new ones • Promotional materials (posters, flyers, guides, DVDs, brochures, leaflets and manuals), • On-farm and on-station research trials and demonstrations
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers cooperatives or financial institutions • Good and enabling agricultural policies • Value addition of the low quality grains • Good marketing structure coupled with prompt payments systems • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, NCPB, KNTC, KEPHIS, County Governments) • Good environmental factors devoid of undesired disruptions • Communication and training about the technology • Have strategic focus, farmers who are organized and willing to adopt, timely operations, good marketing strategy and finances plus other resources • Education level as this determine or influences decision making • Irrigation facilities and mechanization • Development of robust emerging destructive golden apple snails
Partners/stakeholders for scaling up and their role	• Afritec seed ltd, KALRO, NIA, NCPB, KNTC, Universities and KEPHIS for access to quality seed • Agricultural extension services providers for backstopping in dissemination and production • Processors especially millers and government institutions for uptake of produce Seed merchants for seed production and distribution • Financial institutions for credits • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combined harvestors • Agrodealers to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta, Kwale

Challenges in dissemination	• Lack of data and information for sharing with wider audience to maximize benefit of research • Lack of rice innovation platforms and fora for stakeholders engagements • Disseminations/communication barriers including physical barriers, perceptual barriers, emotional/taboos barriers, cultural barriers, language barriers, gender barriers, interpersonal/perceptions/viewpoints barriers. • Lack of attention, interest, distractions, or irrelevance to the receiver • The use of jargon or poorly packed dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• Partners to gather/ collect data and information. • Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches. • Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them. • Early stakeholders engagement during research design, discussions before onset of proposed research with those who will be affected by research output or products. • Develop easy to understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable high yields and desirable market traits are conditions that lead to adoption and thus upscaling. The AFEXH004 is grown also under rainfed lowlands thus utilizing an ecology suitable for mosquito breeding. • The high yield, long slender grains coupled with excellent aroma create a big market. • Absense of flatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most of activities are gender based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 82,831 per acre
Estimated returns	KES 210,250 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income

	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Men perform most of the land preparation, threshing and milling activities Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Men tend to attend most of the training, yet most farm work is carried out by women and youth. • Women and female youth perform most of the transplanting and weeding activities hence there is a need to develop gender-responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exist in the transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.
VMG related opportunities	• Opportunities exists for VMGs especially the female youths in marketing of the produce • Opportunities for youths exists in transportation of the produce to the stores and the markets • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook

F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Afritec Seed Ltd P.O Box 1497, Malindi, Kenya Tel: 0748 327366
Lead organization and scientists	Afritec Seed Ltd, John Mann
Partner organizations	NIA, KALRO, KEPHIS, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.7 Rice variety AFEXH001

TIMP Name	**Rice variety AFEXH001**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, lodging and susceptibility to diseases
What is it? (TIMP description)	It is a high-yielding variety (less than 65 bags of 50 kg per acre), aromatic (90ppb compared to 175ppb of 2-AP in NIBAM10 & 11) and with long slender grains. It is early maturing taking 102 days.
Justification	The gap between local production (300,000 mt per year^{-}) and consumption (850,000 mt per year) is huge and AFEXH001 due to its high yields and good grain quality can help bridge this consumption gap thus saving foreign exchange.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, Agripreneurs
Approaches to be used in dissemination	• Agricultural shows, exhibitions and innovation fora and platforms • Public and private agricultural extension services • Conferences, workshops, meetings including public barazas, professional associations, agricultural fairs • Digital Platforms (Website, Dashboards, Apps, social media short message services) and Mass Media • Farmer Field and Business Schools • Promotional materials (posters, flyers, guides, DVDs, brochures, leaflets and manuals), • On-farm and on-station research trials and demonstrations

Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers cooperatives or financial institutions • Good and enabling agricultural policies • Good marketing structure coupled with prompt payments systems • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, NCPB, KNTC, KEPHIS, County Governments) for capacity building and promotion • Good environmental factors devoid of undesired disruptions
Partners/stakeholders for scaling up and their role	• Afritec Seed Ltd, KALRO, NIA, NCPB, KNTC, Universities and KEPHIS for access to quality seed • Agricultural extension services providers for backstopping in dissemination and production • Processors especially millers and government institutions for uptake of produce Seed merchants for seed production and distribution • Financial institutions for credits • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combined harvestors • Agrodealers to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga and Kisumu
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with wider audience to maximize benefit of research • Lack of rice innovation platforms and fora for stakeholders engagements • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• KALRO and partners to gather/ collect data and information. • Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches. • Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them. • Develop easy to understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available.

Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable high yields and desirable market traits are conditions that lead to adoption and thus upscaling. The AFEXH001 is grown also under rainfed lowlands thus utilizing an ecology suitable for mosquito breeding. • The high yield, long slender grains coupled with excellent aroma create a big market. • Absence of flatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most of activities are gender based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 82,831 per acre
Estimated returns	KES 219,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Men tend to attend most of the training, yet most farm work is carried out by women and youth. • Women perform most of the transplanting and weeding activities hence there is need to develop gender-responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exists in the the transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge. • VMGs have limited access to education, training and extension services.

	• Due to their social status VMGs are often excluded from decision-making in development and dissemination activities.
VMG related opportunities	• Opportunities exists for VMGs in marketing the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Afritec Seed Ltd P.O Box 1497, Malindi, Kenya Tel: 0748 327366
Lead organization and scientists	Afritec Seed LTD, John Mann
Partner organizations	NIA, KALRO, KEPHIS, AATF, Icoseed, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.8 Rice variety AT054

TIMP Name	**Rice variety AT054**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, lodging and susceptibility to diseases
What is it? (TIMP description)	It is a high yielding (less than 61 bags of 50 kg per acre) and aromatic (220ppb higher than NIBAM10 & 11) variety. AT054 is open-pollinated and extra early maturing, taking 84-135 days.
Justification	The gap between local production (300,000 mt per year) and consumption (850,000 mt per year) is huge and AT054 is a potential

	candidate due to its good yields and superior grain quality with an extremely strong aroma to abridge this gap resulting in saving foreign exchange used to import rice.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, consumers
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Training - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer-to-farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Good and enabling agricultural policies • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) for capacity building and promotion • Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• Afritec seed Ltd, KALRO, NIA, Icoseed Kenya, AATF, NCPB, KNTC, Universities and KEPHIS - for access to quality seed • Agricultural extension services providers - for backstopping in dissemination and production • Processors especially millers and government institutions - for uptake of produce Seed merchants for seed production and distribution • Financial institutions- avail credit • Mechanization units, entrepreneurs - to provide land preparation, planting, weeding services, combine harvesters • Agrodealers - to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with a wider audience to maximize the benefit of research • Lack of rice innovation platforms and fora for stakeholder engagements • Poorly packaged dissemination pathways • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers

Suggestions for addressing the challenges	• Partners to gather/ collect data and information • Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches. • Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them. • Develop easy-to-understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available.
Lessons learned in upscaling if any	• Farmers in Kabatiro area in Kirinyaga county have been growing AT054 hybrid that has a strong aroma and high yielding of up to 2.5 times the traditional pishori. The hybrid AT054 matures two weeks earlier than the local pishori which implies that in case of water stress, it is less affected. The variety's strong aroma makes the it popular in the market. It is disease and pest tolerant thus requires few sprays to control the diseases thus it is environmentally friendly.
Social, environmental, policy and market conditions necessary for development and upscaling	• The acceptable high yields and desirable market traits are conditions that lead to adoption and thus upscaling. The AT054 is grown also under rainfed lowlands thus utilizing an ecology suitable for mosquito breeding. • The high yield, long slender grains coupled with excellent aroma create a big market. • Absense of flatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most of activities are gender based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 82,831 per acre
Estimated returns	KES 213,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Men tend to attend most of the trainings, yet most farm work is carried out by women and youth. • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise

	• Women and female youth perform most of the transplanting and weeding activities hence there is need to develop gender-responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exists for women in the marketing the produce • Opportunities for youth in transportation of the produce to the stores and the market • Opportunities exist for women and youth in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision-making in development and dissemination activities.
VMG related opportunities	• Opportunities exist for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Afritec Seed Ltd P.O Box 1497, Malindi, Kenya Tel: 0748 327366
Lead organization and scientists	Afritec Seed LTD, John Mann
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AATF, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.9 Rice variety AH18002

TIMP Name	Rice variety AH18002
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields and late maturity
What is it? (TIMP description)	It is a high-yielding variety, producing more than 73 bags of 50 kg per acre. It early maturing, taking less than 99 days. It is best suited for areas with an altitude of 0-1700 masl. The variety is suitable for most rice growing areas of Kenya.
Justification	The variety is high-yielding and could contribute to bridging the gap between local production of 300,000 mt per year) and consumption of 850,000 mt per year, therefore enhancing saving on foreign exchange from less importation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders and Agrepreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Training - Workshops/Seminars/Meetings • Public and private Extension Agents • Farmer-to-farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers' cooperatives or financial institutions • Collaboration among research, partners and regulatory institutions (KALRO, AATF, CGA, NIA, MoALD, Icoseed Kenya, NCPB, KNTC, KEPHIS, County Governments) for promotion and capacity building • Good environmental factors devoid of undesired disruptions • Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• HEAL, KALRO, NIA, Icoseed Kenya, AATF, AHyRA, NCPB, KNTC, Universities and KEPHIS for access to quality seed • Agricultural extension services providers for backstopping in dissemination and production • Processors especially millers and government institutions for uptake of produce Seed merchants for seed production and distribution

	• Financial institutions for credits • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combine harvesters • Agrodealers to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu and Kilifi
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of effective rice innovation platforms and fora for stakeholder engagements and deliberations • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Unfavourable policies especially when dealing with mass media • Language barrier – scientific language is not easy to understand for non-scientists and results may be available in non-local language • Poorly packaged dissemination pathways • Lack of data and information for sharing with a wider audience to maximize the benefit of research e.g. information on golden apple snail • Lack of appropriate knowledge and skills by the farming community • Lack of monitoring and evaluation tools for early interventions in emerging issues that may derail dissemination.
Suggestions for addressing the challenges	• Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Involve County Governments and partners in the developments of extension materials and dissemination programmes. • Create and formulate enabling policy environment for sustainable dissemination of TIMPs • Develop easy to understand extension materials, Implementation of new ICT tools, and engaging those in the community (influencers) whose support is required for benefits accrue • Develop dissemination materials suitable for all categories of people with disability • Anticipate likely barriers to dissemination and address them • Afritec Seed, NIA, Icoseed Kenya, AATF, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Community or target audience mobilization and clarification of any issues they may have, which may involve study tours, exchange • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available

	• Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination
Lessons learned in upscaling if any	Not available
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains coupled with excellent aroma and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and thus upscaling. The AH18002 is grown also under rainfed lowlands thus utilizing an ecology suitable for mosquito breeding this coupled with disease and pest-resistant resistance implies less chemicals that are injurious to the environment and biodiversity are used. • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 90,831 per acre
Estimated returns	KES 250,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision-making processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Men tend to attend most of the training, yet most farm work is carried out by women and youth. • Women and female youth perform most of the transplanting and weeding activities hence there is need to develop gender - responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exists in the transportation of the produce to the stores and the market • Opportunities exist for women and youth in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness • VMGs have limited access to education, training and extension services.

	• Due to their social status VMGs are often excluded from decision-making in development and dissemination activities.
VMG related opportunities	• Opportunities exist for VMGs especially the female youths in marketing the produce • Opportunities for youths exist in the transportation of the produce to the stores and markets • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Afritec Seed Ltd P.O Box 1497, Malindi, Kenya Tel: 0748 327366
Lead organization and scientists	AATF, Kayode A. Sanni
Partner organizations	HEAL, AHyRA, NIA, KALRO, KEPHIS, CGA, Icoseed Kenya, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.10 Rice variety AH18003

TIMP Name	Rice variety AH18003
	 *AH18003 rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, moisture stress and late maturity
What is it? (TIMP description)	It is a high-yielding variety, producing more than 78 bags of 50 kg per acre. It is early maturing, taking 99-124 days. AH18003 is best suited in areas with an altitude of 0-1700 masl, with day and night temperatures of around 25^0C and 17^0C respectively. It can tolerate moisture stress and grows under both irrigated and rainfed lowlands.
Justification	AH18003 variety is high-yielding and could contribute to bridging the gap between local production of 300,000 mt per year against the consumption of 850,000 mt per year, therefore saving on foreign exchange from less importation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, consumers, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Good and enabling agricultural policies • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) for capacity building and promotion

	• Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• Afritec Seed , KALRO, NIA, Icoseed Kenya, AATF, NCPB, KNTC, Universities and KEPHIS for access to quality seed • Agricultural extension services providers- for backstopping in dissemination and production • Processors especially millers and government institutions - for uptake of produce Seed merchants for seed production and distribution • Financial institutions - for credits • Mechanization units and entrepreneurs - to provide land preparation, planting, weeding services, combine harvesters • Agrodealers- to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu and Kilifi
Counties where TIMP will be upscaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of effective rice innovation platforms and fora for stakeholder engagements and deliberations • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Unfavourable policies especially when dealing with mass media • Language barrier – scientific language is not easy to understand for non-scientists and results may be available in non-local language • Poorly packaged dissemination pathways • Cultural, language and gender barriers • Lack of data and information for sharing with a wider audience to maximize the benefit of research e.g. information on golden apple snail • Lack of appropriate knowledge and skills by the farming community • Lack of monitoring and evaluation tools for early interventions in emerging issues that may derail dissemination.
Suggestions for addressing the challenges	• Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Involve County Governments and partners in the developments of extension materials and dissemination programmes. • Create and formulate enabling policy environment for sustainable dissemination of TIMPs • Develop easy-to-understand extension materials, Implementation of new ICT tools, and engaging those in the community (influencers) whose support is required for benefits accrue

	• Develop dissemination materials suitable for all categories of people with disability • Anticipate likely barriers to dissemination and address them • Afritec Seed LTD, NIA, Icoseed Kenya, AATF, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Community or target audience mobilization and clarification of any issues they may have, which may involve study tours, exchange • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available • Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains, excellent aroma, and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and thus upscaling. The AH18003 grows under rainfed lowlands thus utilizing an ecology suitable for mosquito breeding this coupled with disease and pest-resistant resistance, implies less chemicals that are and harmful to the environment and biodiversity are used. • Absence of aflatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 90,000 per acre
Estimated returns	KES 252,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Men tend to attend most of the training, yet most farm work are carried out by women and youth.

	• Women and female youth perform most of the transplanting and weeding activities hence there is need to come up with gender responsive transplanting and weeding tools.
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit. • Opportunities exists for women in the marketing the produce. • Opportunities for youth exist in transportation of the produce to the stores and the market. • Opportunities exist for women and youth in transplanting and weeding.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision-making in development and dissemination activities.
VMG related opportunities	• Opportunities exist for VMGs in marketing the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Afritec Seed Ltd P.O Box 1497, Malindi, Kenya Tel: 0748 327366 Afritec Seed Ltd is licensed by AATF to produce, market & sell AH18003 in Kenya
Lead organization and scientists	Afritec Seed LTD, John Mann
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AATF, AHyRA, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.11 Rice variety AH18004

TIMP Name	Rice variety AH18004
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields and late maturity
What is it? (TIMP description)	It is a high-yielding variety, producing about 77 bags of 50 kg per acre. AH18004 is early maturing taking less than 98 days. It is best suited for areas with an altitude of 0-1700 masl, with day and night temperatures of around 25^0C and below 17^0C
Justification	It is high yielding and that could contribute to bridging the gap between local production of 300,000 mt per year against consumption of 850,000 mt per year, hence saving on foreign exchange from less importation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, Consumers and Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Training - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer-to-farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Participatory on-farm demonstrations by stakeholders • Good and enabling agricultural policies • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) for promotion and capacity building • Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• SEEDCO, KALRO, NIA, Icoseed Kenya, AATF, NCPB, KNTC, Universities and KEPHIS - for access to quality seed • Agricultural extension services providers- for backstopping in dissemination and production • Processors especially millers and government institutions - for uptake of produce Seed merchants for seed production and distribution • Financial institutions - for credits • Mechanization units and entrepreneurs - to provide land preparation, planting, weeding services, combined harvestors • Agrodealers - to avail seeds and inputs to farmers

C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu and Kilifi
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of effective rice innovation platforms and fora for stakeholder engagements and deliberations • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Unfavourable policies especially when dealing with mass media • Language barrier – scientific language is not easy to understand for non-scientists and results may be available in non-local language • Poorly packaged dissemination pathways • Cultural, language and gender barriers • Lack of data and information for sharing with a wider audience to maximize the benefit of research e.g. information on golden apple snail • Lack of appropriate knowledge and skills by the farming community • Lack of monitoring and evaluation tools for early interventions of emerging issues that may derail dissemination.
Suggestions for addressing the challenges	• Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Involve County Governments and partners in the development of extension materials and dissemination programmes. • Create and formulate an enabling policy environment for sustainable dissemination of TIMPs • Develop easy-to-understand extension materials, Implement new ICT tools, and engage those in the community (influencers) whose support is required for benefits to accrue • Develop dissemination materials suitable for all categories of people with disability • Anticipate likely barriers to dissemination and address them • SEEDCO, CGA, NIA, Icoseed Kenya, AATF, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Community or target audience mobilization and clarification of any issues they may have, which may involve study tours and exchange • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available

	• Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination interventions.
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains, excellent aroma, and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and thus upscaling. The AH18004 is grown also under rainfed lowlands thus utilizing an ecology suitable for mosquito breeding, coupled with disease and pest resistance implies less chemicals that are harmful to the environment and biodiversity are used. • Absence of aflatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 90,000 per acre
Estimated returns	KES 259,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Men attend most of the training, yet most farm work are carried out by women and youth. • Women and female youth perform most of the transplanting and weeding activities hence there is need to develop gender-responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exist in the transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation.

	• There is low adoption by the VMGs due to lack of awareness • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.
VMG related opportunities	• Opportunities exist for VMGs especially the youth in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	AATF P.O. Box 30709-00100, Nairobi Kenya Tel: 020 422 3700
Lead organization and scientists	AATF Kayode A. Sanni
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AATF, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.12 Rice variety AH18007

TIMP Name	**Rice AH18007**
	 *AH18007 rice variety*

Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, and late maturity
What is it? (TIMP description)	It is a moderate maturing variety (98-126 days), with high yields (more than 73 bags of 50 kg per acre) and with high milling turnover. It has long slender grains. It grows best from 0-1700 masl especially in Mwea and western Kenya, which have night temperatures above 17^0C and day temperatures of around 25^0C during grain filling.
Justification	The gap between local production (300,000 mt per year) and consumption (850,000 mt per year) is huge. Due to its high yields and good grain quality it can help abridge this consumption gap thus saving foreign exchange used for importation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers' cooperatives or financial institutions • Good and enabling agricultural policies • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) for capacity-building and promotion • Good marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• Afritec seed, KALRO, NIA, Icoseed Kenya, AATF, NCPB, KNTC, Universities and KEPHIS for access to quality seed • Agricultural extension services providers- for backstopping in dissemination and production • Processors especially millers and government institutions - for uptake of produce Seed merchants for seed production and distribution • Financial institutions- for credits • Mechanization units and entrepreneurs - to provide land preparation, planting, weeding services, combine harvesters • Agrodealers - to avail seeds and inputs to farmers

C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Kilifi, Bura, Hola and Malindi
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of effective rice innovation platforms and fora for stakeholder engagements and deliberations • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Unfavourable policies especially when dealing with mass media • Language barrier – scientific language is not easy to understand for non-scientists and results may be available in non-local language • Poorly packaged dissemination pathways • Lack of data and information for sharing with a wider audience to maximize benefit of research e.g. information on golden apple snail • Lack of appropriate knowledge and skills by the farming community • Lack of monitoring and evaluation tools for early interventions of emerging issues that may derail dissemination.
Suggestions for addressing the challenges	• Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Involve County Governments and partners in the developments of extension materials and dissemination programmes. • Create and formulate enabling policy environment for sustainable dissemination of TIMPs • Develop easy to understand extension materials, Implementation of new ICT tools, and engaging those in the community (influencers) whose support is required for benefits accrue • Develop dissemination materials suitable for all categories of people with disability • Anticipate likely barriers to dissemination and address them • Afritec Seed LTD, NIA, Icoseed Kenya, AATF, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Community or target audience mobilization and clarification of any issues they may have, may involve study tours, exchange • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available • Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination interventions.

Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains, excellent aroma, and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and thus upscaling. The Trenasse is grown also under rainfed lowlands thus utilizing an ecology suitable for mosquito breeding this coupled with disease and pest resistance implies less chemicals that are harmful to the environment and biodiversity are used. • Absence of aflatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 90,000 per acre
Estimated returns	KES 255,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Men attend most of the training, yet most farm work is carried out by women and youth. • Women and female youth perform most of the transplanting and weeding activities hence there is a need to develop gender-responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exist in the transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge.

	• VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision-making in development and dissemination activities.
VMG related opportunities	• Opportunities exist for VMGs especially the female youths in marketing the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Afritec Seed Ltd P.O Box 1497, Malindi, Kenya Tel: 0748 327366 Afritec Seed Ltd is licensed by AATF to produce, market & sell AH18007 in Kenya
Lead organization and scientists	Afritec Seed LTD, John Mann
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AATF, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.13 Rice variety AH18009

TIMP Name	**Rice variety AH18009**
	 *AH18009 rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	

Problem to be addressed	Low yields, grain quality, and late maturity
What is it? (TIMP description)	It is a hybrid variety with early maturity (102-129 days), high yields of more than 76 bags of 50 kg per acre and high milling turnover. AH18009 has long slender grains and grows best from 0-1700 masl, especially Mwea and western Kenya which have night temperatures above 17^0C and day temperatures of around 25^0C during grain filling.
Justification	The gap between local production of 300,000 mt per year against consumption of 850,000 mt per yearis high. Due to its high yields, milling, and good grain quality, the variety can help bridge this consumption gap thus saving foreign exchange used for importation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders and Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers' cooperatives or financial institutions • Good and enabling agricultural policies • Collaboration among research partners and regulatory institutions (KALRO, NIA, MoALD, CGA, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) • Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• AATF, HEAL, KALRO, NIA, CGA, Icoseed Kenya, NCPB, KNTC, Universities and KEPHIS - for access to quality seed • Agricultural extension services providers - for backstopping in dissemination and production • Processors especially millers and government institutions for uptake of produce Seed merchants - for seed production and distribution • Financial institutions - for credits • Mechanization units and entrepreneurs - to provide land preparation, planting, weeding services, combine harvesters • Agrodealers- to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Kilifi, Bura, Hola
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale

Challenges in dissemination	• Lack of effective rice innovation platforms and fora for stakeholder engagements and deliberations • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Unfavourable policies especially when dealing with mass media • Cultural, language and gender barriers • Lack of data and information for sharing with wider audience to maximize benefit of research e.g. information on golden apple snail • Lack of appropriate knowledge and skills by the farming community • Lack of monitoring and evaluation tools for early interventions of emerging issues that may derail dissemination.
Suggestions for addressing the challenges	• Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Involve County Governments and partners in the developments of extension materials and dissemination programmes. • Create and formulate an enabling policy environment for sustainable dissemination of TIMPs • Develop easy-to-understand extension materials, Implementation of new ICT tools, and engage those in the community (influencers) whose support is required for benefits to accrue • Develop dissemination materials suitable for all categories of people with disability • Anticipate likely barriers to dissemination and address them • HEAL, NIA, Icoseed Kenya, AATF, AHyRA, CGA, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Community or target audience mobilization and clarification of any issues they may have, may involve study tours, exchange • Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination interventions.
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains, excellent aroma, and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and thus upscaling. • Absence of aflatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 90,000 per acre
Estimated returns	KES 256,290 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields • Men perform most of the land preparation, threshing and milling activities Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Men tend to attend most of the trainings, yet most farm work are carried out by women and youth • Women and female youth perform most of the transplanting and weeding activities hence there is need to develop gender-responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exist in the transportation of the produce to the stores and the market • Opportunities exist for women and female youth in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to land for rice cultivation • There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision-making in development and dissemination activities
VMG related opportunities	• Opportunities exist for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya.

	https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	AATF P.O. Box 30709-00100, Nairobi Kenya Tel: 020 422 3700
Lead organization and scientists	AATF, Kayode A. Sanni
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AATF, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.14 Rice variety AH19003

TIMP Name	**Rice variety AH19003**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, and late maturity
What is it? (TIMP description)	It is a moderate maturing variety (98-126 days), with high yields (more than 73 bags of 50 kg per acre) variety with high milling turn over. It has long slender grains and grows best from 0-1700 masl especially in Mwea and western Kenya, which have night temperature above 17^0C at night and day temperature of around 25^0C during grain filling.
Justification	The gap between local production of 300,000 per mt year against the consumption of 850,000 mt per year is high. Due to its high yields and good grain quality it can help abridge this consumption gap, thus saving foreign exchange used for importation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders and Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services

Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Good and enabling agricultural policies • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) • Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• Afritec seed, KALRO, NIA, Icoseed Kenya, AATF, NCPB, KNTC, Universities and KEPHIS - for access to quality seed • Agricultural extension services providers - for backstopping in dissemination and production • Processors especially millers and government institutions - for uptake of produce Seed merchants for seed production and distribution • Financial institutions - for credits • Mechanization units, entrepreneurs - to provide land preparation, planting, weeding services, combine harvesters • Agrodealers - to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Kilifi, Bura, Hola anf Malindi
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of effective rice innovation platforms and fora for stakeholder engagements and deliberations • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Unfavourable policies especially when dealing with mass media • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Lack of data and information for sharing with a wider audience to maximize the benefit of research e.g. information on golden apple snail • Lack of appropriate knowledge and skills by the farming community • Lack of monitoring and evaluation tools for early interventions of emerging issues that may derail dissemination.
Suggestions for addressing the challenges	• Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Involve County Governments and partners in the developments of extension materials and dissemination programmes. • Create and formulate enabling policy environment for sustainable dissemination of TIMPs • Develop easy to understand extension materials, Implementation of new ICT tools, and engaging those in the

	community (influencers) whose support is required for benefits accrue • Develop dissemination materials suitable for all categories of people with disability • Anticipate likely barriers to dissemination and address them • Afritec Seed LTD, NIA, Icoseed Kenya, AATF, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Community or target audience mobilization and clarification of any issues they may have, may involve study tours, exchange • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available • Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination interventions.
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and thus upscaling. • Absence of aflatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfare
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 90,000 per acre
Estimated returns	KES 255,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Men attend most of the training, yet most farm work is carried out by women and youth. • Women and female youth perform most of the transplanting and weeding activities, hence there is need to develop gender-responsive transplanting and weeding tools

Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exist in transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.
VMG related opportunities	• Opportunities exist for VMGs especially the female youths in marketing the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Afritec Seed Ltd P.O Box 1497, Malindi, Kenya Tel: 0748 327366 Afritec Seed Ltd is licensed by AATF to produce, market & sell AH18007 in Kenya
Lead organization and scientists	Afritec Seed LTD, John Mann
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AATF, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.15 Rice variety AH19006

TIMP Name	Rice variety AH19006
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields and late maturity
What is it? (TIMP description)	It is a high yielding variety, producing about 77 bags of 50 kg per acre. It is early maturing, taking less 98 days and is best suited in areas with an altitude of 0-1700 masl, with day temperatures of around 25^0C and night temperatures of below 17^0C
Justification	The variety is high yielding and could contribute to bridging the gap between local production of 300,000 mt per year against consumption of 850,000 mt per year, hence saving on foreign exchange from less importation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Training- Workshops/Seminars/Meetings • Public and private Extension Agents • Farmer-to-farmer extension models • Mass media- Electronic and print • Publications -Posters/brochures/leaflets, manuals • Digital Platforms- Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Participatory on-farm demonstrations by stakeholders • Good and enabling agricultural policies • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) • Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• AATF, KALRO, NIA, Icoseed Kenya, AHyRA, NCPB, KNTC, Universities and KEPHIS- for access to quality seed • Agricultural extension services providers - for backstopping in dissemination and production • Processors especially millers and government institutions - for uptake of produce Seed merchants for seed production and distribution • Financial institutions- for credits • Mechanization units, entrepreneurs to provide land preparation, planting, weeding services, combine harvesters • Agrodealers to avail seeds and inputs to farmers

C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with a wider audience to maximize the benefit of research • Lack of rice innovation platforms and fora for stakeholder engagements • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• Afritec seed Ltd, NIA, Icoseed Kenya, AATF, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Community or target audience mobilization and clarification of any issues. • Anticipate likely barriers to dissemination and address them • Develop easy-to-understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available.
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and upscaling. • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 90,000 per acre
Estimated returns	KES 255,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination fora

	• Women and female youth perform most of the transplanting and weeding activities hence there is a need to develop gender-responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exist in the transportation of the produce to the stores and the market • Opportunities exist for women and youth in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision-making in development and dissemination activities.
VMG related opportunities	• Opportunities exist for VMGs especially the female youths in marketing the produce • Affirmative action opportunities exist for VMGs to acquire the required credit.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	AATF P.O. Box 30709-00100, Nairobi Kenya Tel: 020 422 3700
Lead organization and scientists	AATF, Kayode A. Sanni
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AHyRA, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.16 Rice variety AH19007

TIMP Name	Rice variety AH19007
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields and late maturity
What is it? (TIMP description)	It is a high-yielding variety, which yields about 77 bags of 50 kg per acre. It is early maturing, taking less than 98 days and is best suited for areas with an altitude of 0-1700 masl, with day and night temperatures of around 25^0C and less than 17^0C.
Justification	The variety is high-yielding and could contribute to bridging the gap between local production of 300,000 mt per year against consumption of 850,000 mt per year, hence saving on foreign exchange from less importation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Participatory on-farm demonstrations by stakeholders • Good and enabling agricultural policies • Good marketing structure coupled with prompt payments systems • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) • Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• AATF, KALRO, NIA, Icoseed Kenya, AHyRA, NCPB, KNTC, Universities and KEPHIS -for access to quality seed • Agricultural extension services providers - for backstopping in dissemination and production • Processors especially millers and government institutions - for uptake of produce • Seed merchants - for seed production and distribution • Financial institutions - for credits • Mechanization units, entrepreneurs- to provide land preparation, planting, weeding services, combined harvestors

	• Agrodealers - to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMP will be upscaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of effective rice innovation platforms and fora for stakeholder engagements and deliberations • Limited resources to prepare dissemination/ communication materials and attend conferences, seminars, meetings etc • Unfavourable policies especially when dealing with mass media • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Lack of data and information for sharing with a wider audience to maximizthe the benefit of research e.g. information on golden apple snail • Lack of appropriate knowledge and skills by the farming community • Lack of monitoring and evaluation tools for early interventions of emerging issues that may derail dissemination.
Suggestions for addressing the challenges	• Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Involve County Governments and partners in the developments of extension materials and dissemination programmes. • Create and formulate an enabling policy environment for sustainable dissemination of TIMPs • Develop easy-to-understand extension materials, Implementation new ICT tools, and engage those in the community (influencers) whose support is required for benefits to accrue • Develop dissemination materials suitable for all categories of people with disability • Anticipate likely barriers to dissemination and address them • AATF, CGA, NIA, Icoseed Kenya, AHyRA, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Community or target audience mobilization and clarification of any issues they may have which may involve study tours • Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination interventions.

Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains, excellent aroma, and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and thus upscaling. • Absence of aflatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 90,000 per acre
Estimated returns	KES 255,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is need to develop gender responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exists in transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to land for rice cultivation. • There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.
VMG related opportunities	• Opportunities exists for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit.

E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	AATF P.O. Box 30709-00100, Nairobi Kenya Tel: 020 422 3700
Lead organization and scientists	AATF, Kayode A. Sanni
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AHyRA, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.17 Rice variety Trenasse

TIMP Name	**Rice variety Trenasse**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, lodging and susceptibility to diseases and pests
What is it? (TIMP description)	It is an early maturing variety (75-120 days), with high yields of more than 49 bags of 50 kg per acre, high ratoonability, excellent threshability and resistance to blast, brown spot and stemborers. Trenasse is semi-dwarf with long grains, of intermediate amylose content, non-aromatic, cooks dry and non-sticky and intermediate gelatinization temperature. It grows best from 0-1700 masl and night temperatures should not fall below 17^0C. It does best when temperatures are around 25^0C during grain filling.
Justification	The gap between local production of 300,000 mt per year and consumption of 850,000 mt per year is high and Trenasse due to its high yields and good grain quality, can help bridge this consumption gap, thus saving foreign exchange used for importation.

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, Agripreneurs
Approaches to be used in dissemination	
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers cooperatives or financial institutions • Good and enabling agricultural policies • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) • Effective marketing strategy and marketing channels
Partners/stakeholders for scaling up and their role	• Afritec seed, KALRO, NIA, Icoseed Kenya, AATF, NCPB, KNTC, Universities and KEPHIS - for access to quality seed • Agricultural extension services providers- for backstopping in dissemination and production • Processors especially millers and government institutions for uptake of produce Seed merchants - for seed production and distribution • Financial institutions- for credits • Mechanization units and entrepreneurs- to provide land preparation, planting, weeding services, combined harvestors • Agrodealers to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu and Kilifi
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with a wider audience to maximize the benefit of research • Lack of rice innovation platforms and fora for stakeholder engagements • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• Afritec seed Ltd, NIA, Icoseed Kenya, AATF, KALRO, NCPB, KNTC and other collaborating partners to collect necessary data and information for sharing after synthesizing it into understandable form to different end-users • Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches

	• Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them • Develop easy-to-understand information packages for farmers. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available.
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains, excellent aroma, and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and thus upscaling. • Absence of aflatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 82,831 per acre
Estimated returns	KES 208,250 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is a need to develop gender responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exist in the the transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to land for rice cultivation

	• There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision-making in development and dissemination activities.
VMG related opportunities	• Opportunities exist for VMGs especially the female youths in marketing the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	Afritec Seed Ltd P.O Box 1497, Malindi, Kenya Tel: 0748 327366
Lead organization and scientists	Afritec Seed LTD, John Mann
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AATF, NCPB, KNTC, National & County Governments, Cooperatives

2.2.1.18 Rice variety SC213

TIMP Name	**Rice variety SC213**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, grain quality, lodging and susceptibility to diseases
What is it? (TIMP description)	It is a high tillering variety, with good threshability, high yielding (more than 70 bags of 50 kg per acre) and is resistant to blast,

	stemborers and lodging. SC213 is non-aromatic, with long slender grains. It is early maturing taking 120-135 days. The grain is of intermediate amylose content and thus cooks dry and nonsticky.
Justification	The gap between local production (300,000 mt per year) and consumption (850,000 mt per year) is huge and due to its high yields and good grain quality, SC213 can help bridge this consumption gap, thus saving foreign exchange used for importation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed merchants, Researchers, Agriculture service providers, Processors, Traders, consumers
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers' cooperatives or financial institutions • Enabling agricultural policies • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) • Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• Afritec seed, KALRO, NIA, Icoseed Kenya, AATF, NCPB, KNTC, Universities and KEPHIS - for access to quality seed • Agricultural extension services providers - for backstopping in dissemination and production • Processors especially millers and government institutions for uptake of produce Seed merchants- for seed production and distribution • Financial institutions - for credits • Mechanization units and entrepreneurs - to provide land preparation, planting, weeding services, combined harvestors • Agrodealers- to avail seeds and inputs to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of data and information for sharing with wider audience to maximize benefit of research • Lack of rice innovation platforms and fora for stakeholders engagements

	• Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• KALRO and partners to gather/ collect data and information. • Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches. • Community or target audience mobilization and clarification of any issues. Anticipate likely barriers to dissemination and address them. • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available.
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	• The high yield, long slender grains, excellent aroma, and cooking qualities create a big market. • The acceptable high yields, excellent cooking qualities and desirable market traits are conditions that lead to adoption and thus upscaling. • Absence of aflatoxin and other contaminants and harmful factors are necessary factors for upscaling due to acceptance • Most activities are gender-based and this has the effect of being inclusive hence leading to wider adoption resulting in improved socio-welfares
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 82,831 per acre
Estimated returns	KES 200,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is a need to develop gender responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exist in the transportation of the produce to the stores and the market

	• Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to land for rice cultivation • There is low adoption by the VMGs due to lack of awareness VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision-making in development and dissemination activities.
VMG related opportunities	• Opportunities exist for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Afritec Seed Ltd P.O Box 1497, Malindi, Kenya Tel: 0748 327366
Lead organization and scientists	Afritec Seed Ltd John Mann
Partner organizations	NIA, KALRO, KEPHIS, Icoseed Kenya, AATF, NCPB, KNTC, National & County Governments, Cooperatives

2.2.2 Upland rice varieties

2.2.2.1 Rice variety Dourado Precoce

TIMP Name	Rice variety Dourado Precoce
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low rainfed upland yields, late maturity, susceptibility to diseases
What is it? (TIMP description)	It is a variety that is adapted to rainfed upland (15-1700 masl) with a potential yield of more than 19 bags of 50 kg bags per acre. The variety has good drought tolerance and is tolerant to blast, BLB and RYMV. It is early maturity (95-115 days) and plant is 122 cm. The length-breadth ratio is 2.85, thus classified as long grain.
Justification	It has moderate yield, with desirable market and consumer traits. Dourado precoce has good milling out turn (above 65%) and good taste, texture and appearance. It is climate-smart as it can tolerate high temperatures and moisture stress, with no yield penalty compared to other upland varieties. It does fairly well even under moderate saline soils, where other varieties show stress.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Processors, Seed merchants, Researchers, Agricultural service providers, Traders, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Robust seed system to support adoption • Participatory on-farm demonstrations by stakeholders • Credit availability either from farmers' cooperatives or financial institutions • Enabling agricultural policies • Collaboration among research, partners and regulatory institutions (KALRO, NIA, MoALD, Icoseed Kenya, AATF, NCPB, KNTC, KEPHIS, County Governments) • Effective marketing strategy and communication channels
Partners/stakeholders for scaling up and their role	• KALRO, AfricaRice and KEPHIS- for access to quality seed • Seed merchants- for seed production and distribution • Agrodealers- to avail seeds and inputs to farmers

	• Mechanization units, entrepreneurs - to provide land preparation, planting, weeding services, combine harvesters • Agricultural extension services providers- for backstopping in dissemination and production • Financial institutions- for credits
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta, Tana River, Kilifi, Kwale, Muranga, Tharaka Nthi, Marsabit, Garissa, Mandera, Isiolo, Baricho, Kakamega and Bungoma
Counties where TIMP will be up scaled	Busia, Siaya, Homabay, Migori, Bungoma, Kakamega, West-Pokot, Elgeyo-Marakwet, Muranga, Embu, Tharaka-Nithi, Meru, Isiolo, Kwale and Kilifi
Challenges in dissemination	• Lack of data and information for sharing with a wider audience to maximize the benefit of research • Lack of rice innovation platforms and fora for stakeholder engagements • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension provide
Suggestions for addressing the challenges	• KALRO and partners to gather/ collect data and information • Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Education and training to ensure the skills and knowledge required for meaningful promotion of results and application of research findings to achieve intended purposes is available • Community or target audience mobilization and clarification of any issues they may have, may involve study tours, exchange • Implementation of new ICT tools, research outputs focusing on the desired end-point and engaging those in the community (influencers) whose support is required for benefits accrue • Anticipate likely barriers to dissemination and address them • Use monitoring and evaluation tools for early interventions in adaptation and refinement to fit local conditions and emerging issues that may derail dissemination
Lessons learned in upscaling if any	• High success in scaling/adoption is achieved when value chain stakeholders collaborate and work together • Demonstrations, agricultural shows and field days are powerful tools for awareness creation necessary for out scaling • Certified seed availability and accessibility and other inputs in a sustainable manner are crucial in TIMPs upscaling • Availability of off-take markets is a key driver for adoption of a technology • Availability of resources (finances, facilities, personnel, time) for promotion are important for technology upscaling

Social, environmental, policy and market conditions necessary for development and upscaling	• Variety Dourado precoce is produced under rainfed upland ecologies and thus use less water compared to other upland varieties. • The acceptable yields and desirable market traits make it popular • There is need to organize value chain players into a forum or platform for easy engagement and policy formulation/reviews in right of emerging scenerios • Aflatoxin contamination need to be investigated for food safty mitigation measure • Most of activities are gender based thus need for customerization of gender issues for fairness and equity
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 46,600 per acre
Estimated returns	KES 90,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is need to come up with gender responsive transplanting and weeding tools • Men perform most of the land preparation, threshing and milling activities
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit • Opportunities exists for women in the marketing the produce • Opportunities for youth males exists in transportation of the produce to the stores and the market • Opportunities exist for women and female youth in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exists for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit

E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G. Contacts	
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org, cdmwea@yahoo.com 2. Institute Director, Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea & Mtwapa; Dr. Ruth Musila; Dr. John Kimani
Partner organizations	KALRO, AfricaRice, KEPHIS, NIA, National & County Governments, Cooperatives

2.2.2.2 Rice variety NERICA 1

TIMP Name	**Rice variety NERICA 1**
	 *NERICA 1 rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, long maturing varieties which do not fit in the upland ecology in Kenya, poor grain quality and susceptibility to disease
What is it? (TIMP description)	Nerica 1 rice variety is aromatic, early maturing (95 - 100 days) suitable for uplands cultivation . It produces average yields of 1.8 tonnes per acre. It is moderately resistant to rice blast and resistance to insects and lodging.,

Justification	Small-scale farmers growing rice in the upland ecology in Kenya cultivate long-duration varieties, which are not adapted to the ecology due to a lack of choice of other varieties for the ecology. Being an upland variety that is early maturing, has moderate resistance to leaf blast, is resistant to insects and lodging, aromatic and good grain quality, makes NERICA 1 a good bet for growing in the upland ecology, where it is well adapted to even with climate variability.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Seed merchants, Researchers, Agriculture service providers, Traders, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications –posters, brochures, leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Formation of upland rice value chain multistakeholder platform • Availability, accessibility and affordability of certified seeds, • Good seed system to ensure quality, diversification of rice food products through value addition, • Strong partnership linkages, good marketing models and pathways • Active involvement of public and private agricultural service providers. • Availability of financial resources from partners and other donors
Partners/stakeholders for scaling up and their roles	• KALRO Seeds - for production of early generation and certified seeds; • Seed companies - for certified seed production and distribution; • Mechanization units, entrepreneurs - to provide land preparation services, combine harvesters • Agro dealers - selling certified seed; • Agricultural extension service providers (Public and private) - to participate in dissemination; • Financial institutions (banks, donors, credit facilitators)- for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Meru, Embu, Tharaka Nithi, Kakamega, Kwale and Kilifi
Counties where TIMP will be up scaled	Busia, Siaya, Homabay, Migori, Bungoma, Kakamega, West-Pokot, Elgeyo-Marakwet, Muranga, Embu, Tharaka-Nithi, Meru, Isiolo, Kwale, and Kilifi

Challenges in dissemination	• Lack of upland rice innovation platforms to facilitate interaction of farmers and relevant stakeholders, • Unorganized marketing channels, • Limited information on NERICA 1 by agricultural extension service providers (Public and private), • Limited mechanization for upland rice production especially in land preparation, transplanting or sowing, harvesting, storage milling and processing
Suggestions for addressing the challenges	• Establish innovation platforms that involve farmers, national and county governments, seed merchants, NGOs, marketers and processors, information dissemination on good agronomic practices for rice production • Promote marketing models that encourage collective production and marketing, • Facilitate continuous maintenance of early-generation seed by KALRO breeders, • Avail information on NERICA 1 to agricultural service providers for dissemination to farmers.
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and upscaling	• NERICA 1 is a climate change ready crop ndue to its ability to grow under upland conditions and early maturity. • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in rice by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in coast region hence the need to capacity build them, enabling policy and policy review from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 46,600
Estimated returns	KES 109,160
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carryout most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income

	• Due to the triple role of women, they sometimes cannot attend some of the trainings and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is need to develop gender-responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit • Opportunities exists for women in the marketing the produce • Opportunities for youth males exists in transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status, VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exists for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. Guide for NERICA Cultivation https://www.jica.go.jp/Resource/activities/issues/agricul/approach/ku57pq00002m21du-att/guide_for_nerica_en.pdf 2. Somado, A. E., Guei R. G., and Keya S. O. (2008). NERICA: the New Rice for Africa – a compendium. Africa Rice Center, Cotonou, Benin. 3. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 4. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	3- Ready for upscaling

G. Contacts	
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Institute Director: KALRO Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea, KALRO Mtwapa, KALRO Kibos
Partner organizations	AfricaRice, JICA, KEPHIS, National & County Governments, Cooperatives

2.2.2.3 Rice variety NERICA 4

TIMP Name	Rice variety NERICA 4
	 *NERICA 4 rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, Inadequate early maturity varieties for the upland ecology, Poor grain quality and susceptibility to disease
What is it? (TIMP description)	NERICA 4 is early maturing (95 - 100 days) and produces average yields of 2 tonnes per acre. It is drought tolerant, moderately resistant to rice blast and is resitant to insects and lodging. It is non-aromatic with good cooking ability and taste.
Justification	Small-scale farmers growing rice in the upland ecology in Kenya cultivate long maturity varieties which are not adapted to the ecology due to lack of choice of varieties for the ecology. Being an upland variety that is drought tolerant and early maturing, resistant to insests and lodging, moderate resistance to leaf blast, and good grain quality, make NERICA 4 a good bet for growing in the upland ecology where it is well adapted to, even with climate variability. The variety's drought tolerance and early maturity enables it to be promoted in the upland ecology in Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Seed merchants, Researchers, Agriculture service providers, Traders, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station

	• Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Formation of upland rice value chain multistakeholder platform • Availability, accessibility and affordability of certified seeds • Strong partnership linkages, good marketing models and path ways, • Active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• KALRO Seeds for production of early generation and certified seeds; • Seed companies for certified seed production and distribution; • Mechanization units, entrepreneurs to provide land preparation services, combined harvestors • Agro dealers selling of certified seed • Agricultural extension service providers (Public and private) to participate in dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Meru, Embu, Tharaka Nithi, Kakamega, Kwale, Kilifi
Counties where TIMP will be upscaled	Busia, Siaya, Homabay, Migori, Bungoma, Kakamega, West-Pokot, Elgeyo-Marakwet, Muranga, Embu, Tharaka-Nithi, Meru, Isiolo, Kwale, and Kilifi
Challenges in dissemination	• Lack of upland rice innovation platforms to facilitate the interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Limited information on NERICA 4 by agricultural extension service providers (Public and private)
Suggestions for addressing the challenges	• Establish innovation platforms that involve farmers, national and county governments, seed merchants, NGOs, marketers and processors, information dissemination on good agronomic practices for rice production • Promote marketing models that encourage collective production and marketing • Avail information on NERICA 4 to agricultural service providers for dissemination to farmers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in the adoption of new technologies, organized production and market aids in wide adoption,

	• Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to the adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and upscaling	• NERICA 4 is a climate change ready crop due to its ability to grow under upland conditions and early maturity. • Food safety/Health concerns: recommend the use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in rice by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in coast region hence the need to capacity build them, enabling policy and policy review from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 46,600
Estimated returns	KES 109,160
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Men tend to attend most of the training, yet most farm work is carried out by women and youth. • Women and female youth perform most of the transplanting and weeding activities hence there is a need to develop gender responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth exist in the transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services.

	• Due to their social status VMGs are often excluded from decision-making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exist for VMGs especially the female youths in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None in Kenya
Application guidelines for users	1. Guide for NERICA Cultivation https://www.jica.go.jp/Resource/activities/issues/agricul/approach/ku57pq00002m21du-att/guide_for_nerica_en.pdf 2. Somado, A. E., Guei R. G., and Keya S. O. (2008). NERICA: the New Rice for Africa – a compendium. Africa Rice Center, Cotonou, Benin. 3. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 4. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	3- Ready for upscaling
G. Contacts	
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Institute Director: KALRO Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea, KALRO Mtwapa, KALRO Kibos
Partner organizations	AfricaRice, JICA, KEPHIS, National & County Governments, Cooperatives

2.2.2.4 Rice variety NERICA 10

TIMP Name	Rice variety NERICA 10
	 *NERICA 10 rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, inadequate early maturity varieties for the upland ecology, Poor grain quality and susceptibility to disease.
What is it? (TIMP description)	NERICA 4 is an early maturing variety (95 - 100 days), with average yield of 2.4 tonnes per acre. It is drought tolerant, resistant to insects and leaf blast, and shows moderate resistance to lodging. It is non-aromatic with head rice recovery of 63%, good cooking ability and taste.
Justification	Small-scale farmers growing rice in the upland ecology in Kenya cultivate long-duration varieties which are not adapted to the ecology due to a lack of choice of varieties for the ecology. Being an upland variety that is early maturing, resistant to insects and leaf blast, moderate resistance to lodging and good grain quality, make NERICA 10 a good bet for growing in the upland ecology where it is well adapted, even with climate variability. The variety's high yields and early maturity enable it to be promoted in the upland ecology in Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Processors, Seed merchants, Researchers, Agriculture service providers, Traders, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Formation of upland rice value chain multistakeholder platform • Availability, accessibility and affordability of certified seeds, • Good seed system to ensure quality, diversification of rice food products through value addition,

	• Strong partnership linkages, good marketing models and path ways, • Active involvement of public and private agricultural service providers. • Crowding of financial resources from partners and other donors
Partners/stakeholders for scaling up and their roles	• KALRO Seeds for production of early generation and certified seeds; • Seed companies for certified seed production and distribution; • Mechanization units, entrepreneurs to provide land preparation services, combined harvestors • Agro dealers selling of certified seed; • Agricultural extension service providers (Public and private) to participate in dissemination; • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Meru, Embu, Tharaka Nithi, Kakamega, Kwale, Kilifi
Counties where TIMP will be up scaled	Busia, Siaya, Homabay, Migori, Bungoma, Kakamega, West-Pokot, Elgeyo-Marakwet, Muranga, Embu, Tharaka-Nithi, Meru, Isiolo, Kwale, and Kilifi
Challenges in dissemination	• Lack of upland rice innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Limited information on NERICA 10 by agricultural extension service providers (Public and private) • High cost of seeds • Limited rice value-added products. • Limited mechanization for upland rice production especially in land preparation, transplanting or sowing, harvesting, storage and milling and processing
Suggestions for addressing the challenges	• Establish innovation platforms that involve farmers, national and county governments, seed merchants, NGOs, marketers and processors, information dissemination on good agronomic practices for rice production • Mechanize small-scale upland rice production, • promote marketing models that encourage collective production and marketing • promote value addition and consumption of value-added products for increased rice production, • Facilitate continuous maintenance of early-generation seed by KALRO breeders, • licensed seed merchants to produce certified seed • Initiate community-based rice seed production • Avail information on NERICA 10 to agricultural service provides for dissemination to farmers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform,

	• Creation of awareness through demonstrations and farmer field days help in the adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to the adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and upscaling	• NERICA 10 is a climate change ready crop due to its ability to grow under upland conditions and early maturity. • Food safety/Health concerns: recommend the use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in rice by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, is cultivated mainly by women in coast region hence the need to capacity build them, enabling policy and policy review from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 46,600
Estimated returns	KES 111,160
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youths are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is a need to develop gender-responsive transplanting and weeding tools
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exists in transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services.

	• Due to their social status VMGs are often excluded from decision-making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exists for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None in Kenya
Application guidelines for users	1. Guide for NERICA Cultivation https://www.jica.go.jp/Resource/activities/issues/agricul/approach/ku57pq00002m21du-att/guide_for_nerica_en.pdf 2. Somado, A. E., Guei R. G., and Keya S. O. (2008). NERICA: the New Rice for Africa – a compendium. Africa Rice Center, Cotonou, Benin. 3. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 4. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	3- Ready for upscaling
G. Contacts	
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Deputy Institute Director: KALRO Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea, KALRO Mtwapa, KALRO Kibos
Partner organizations	AfricaRice, JICA, KEPHIS, National & County Governments, Cooperatives

2.2.2.5 Rice Variety NERICA 11

TIMP Name	Rice variety NERICA 11
	 *NERICA 11 rice variety*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields, Inadequate early maturity varieties for the upland ecology, Poor grain quality and susceptibility to disease
What is it? (TIMP description)	NERICA 11 is extra early maturing variety, with a maturity period of 75 - 85 days and average yield of 2.8 tonnes per acre. The variety is resistant to insects and leaf blast and shows moderate resistance to lodging. It is non-aromatic, with head rice recovery of 65%, good cooking ability and taste.
Justification	Small-scale farmers growing rice in the upland ecology in Kenya cultivate long duration varieties which are not adapted to the ecology due to lack of choice of varieties for the ecology. Being an upland variety that is extra early maturing, resistant to insects and leaf blast, moderate resistance lodging and good grain quality, make NERICA 11 a good bet for growing in the upland ecology where it is well adapted to, even with climate variability. The variety's high yields and extra early maturity enable it to be promoted in the upland ecology in Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Processors, Seed merchants, Researchers, Agriculture service providers, Traders, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services

Critical/essential factors for successful promotion	• Formation of upland rice value chain multistakeholder platform • Availability, accessibility and affordability of certified seeds • Good seed system to ensure quality, diversification of rice food products through value addition • Strong partnership linkages, good marketing models and pathways • Active involvement of public and private agricultural service providers. • Available financial resources from partners and other donors
Partners/stakeholders for scaling up and their roles	• KALRO Seeds for production of early generation and certified seeds • Seed companies for certified seed production and distribution; • Mechanization units, entrepreneurs to provide land preparation services, combine harvesters • Agro dealers selling certified seed • Agricultural extension service providers (Public and private) to participate in dissemination • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Meru, Embu, Tharaka Nithi, Kakamega, Kwale and Kilifi
Counties where TIMP will be up scaled	Busia, Siaya, Homabay, Migori, Bungoma, Kakamega, West-Pokot, Elgeyo-Marakwet, Muranga, Embu, Tharaka-Nithi, Meru, Isiolo, Kwale, and Kilifi
Challenges in dissemination	• Lack of upland rice innovation platforms to facilitate the interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Limited information on NERICA 11 by agricultural extension service providers (Public and private) • High cost of seeds • Limited rice value-added products. • Limited mechanization for upland rice production especially in land preparation, transplanting or sowing, harvesting, storage and milling and processing
Suggestions for addressing the challenges	• Establish innovation platforms that involve farmers, national and county governments, seed merchants, NGOs, marketers and processors, information dissemination on good agronomic practices for rice production, • Mechanize small-scale upland rice production, • promote marketing models that encourage collective production and marketing, • promote value-addition and consumption of value-added products for increased rice production, • Facilitate continuous maintenance of early-generation seed by KALRO breeders, • licensed seed merchants to produce certified seed, • Initiate community-based rice seed production, • Avail information on NERICA 11 to agricultural service provides for dissemination to farmers.

Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in the adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and upscaling	• NERICA 11 is a climate change ready crop due to its ability to grow under upland conditions and early maturity. • Food safety/Health concerns: recommend the use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in rice by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in the coast region hence the need to capacity build them, enabling policy and policy review from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 46,600
Estimated returns	KES 115,160
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men dominate the rice production decision processes because they are the household and therefore own the rice fields. • Women and youth have less access to land which limits them from fully adopting the enterprise • Women and youth are disadvantaged in their access to other rice inputs, such as credit and capital • While women and youth carry out most of the farm activities, revenue from rice is controlled by men, limiting women and youth access to the use of income • Due to the triple role of women, they sometimes cannot attend some of the training and dissemination forums • Women and female youth perform most of the transplanting and weeding activities hence there is a need to develop gender-responsive transplanting and weeding tools • Men perform most of the land preparation, threshing and milling activities
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit • Opportunities exist for women in the marketing the produce • Opportunities for youth males exist in transportation of the produce to the stores and the market • Opportunities exist for women and female youths in transplanting and weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs have less access to agricultural information, technology and knowledge.

	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Opportunities exists for VMGs in marketing of the produce • Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None in Kenya
Application guidelines for users	1. Guide for NERICA Cultivation https://www.jica.go.jp/Resource/activities/issues/agricul/approach/ku57pq00002m21du-att/guide_for_nerica_en.pdf 2. Somado, A. E., Guei R. G., and Keya S. O. (2008). NERICA: the New Rice for Africa – a compendium. Africa Rice Center, Cotonou, Benin. 3. Kega, V.M, Gikonyo, E.W., Muriithi, C.W., Macharia, J.M. and Muthoni, L. (2015). Rice Cultivation Manual. https://www.kalro.org/download/rice-cultivation-manual/ 4. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	3- Ready for upscaling
G. Contacts	
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Deputy Institute Director: KALRO Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea, KALRO Mtwapa, KALRO Kibos
Partner organizations	AfricaRice, JICA, KEPHIS, National & County Governments, Cooperatives

2.3 RICE SEED SYSTEMS

2.3.1 Improved farmer-saved seed system

TIMPs name	Improved farmer-saved seed system
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Low rice production, Limited seed supply for farmers
What is it? (TIMP description)	Improved farmer-saved seed system is a process of selecting quality seed from the farm before harvesting of the entire crop. Improved farmer-saved-seed-system involves identifying a plot with uniform plants that are true to type. The selected plants are then harvested early and dried well. The paddy is threshed and dried at 13% moisture content and stored in dry, clean well-ventilated place or in hermetic containers for planting in the next season. Before planting, germination tests are done to determine the seed rate viability. Improved farmer-saved-seed selection should only be practiced on one variety for a maximum of three seasons then the farmer should get certified seed.
Justification	Farmer saved rice seed produced under improved farmer-saved seed system is usually of high quality and purity. Cultivation of traditional and improved pure line rice varieties using farm saved seed produced under improved farmer-saved-seed system contributes to increased yields, maintain genetic purity and conserve biodiversity of farmer preferred traditional rice varieties with good attributes such as pest and disease resistance, grain quality and adaptability. Collections from these landraces is likely to make significant contributions during the research processes.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Researchers, Extension service, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Development, validation, promotion and documentation of improved farmer-saved-seed-system • Active involvement of public and private agricultural service providers. • Well organized farmer groups and networks. • County government support in sensitizing farmers.

	• Applied research to develop, validate and promote improved climate smart open pollinated rice varieties, where quality seed can be produced
Partners/stakeholders for scaling up and their roles	• KALRO to provide certified generation 1 seed of improved pure line rice varieties. • KALRO in collaboration County, MoALD extension officers- to validate and document improved farmer-saved-seed-system. • Farmers/farmer groups to adopt improved farmer-saved-seed-system to produce seed for own use. • Financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted, if any	None
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Improved farmer-saved-seed-system is not well documented. • Agricultural extension officers lack of knowledge and skills to disseminate improved farmer-saved-seed-system • Unorganized farmer groups to ease trainings. • Unwillingness of farmers to embrace improved farmer-saved-seed-system. • Farmers with small rice farms each growing different rice varieties making it difficult to maintain purity. • Low awareness of importance of quality rice seed in most parts of Kenya
Recommendations for addressing the challenges	• Validate and document improved farmer-saved-seed-system. • Develop manuals for training • Organise farmer groups/CIGs/VMGs at community level for ease of training and follow up • Identify and train public and private agricultural extension officers, and lead farmers to be ToTs on improved farmer-saved-seed-system for ease of dissemination • Financial institutions (banks, donors, credit facilitators)for financial solution
Lessons learned in upscaling, if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Establish innovation platforms that involves farmers, national and county governments and NGOs to promote use of quality rice seed. • Creation of awareness on importance of practicing improved farm-saved-seed-system instead of using traditional farmer-saved-seed-system. • Registration of CIGs/VMGs will ease dissemination and follow up.

	• Harmonious gender and social consideration in research, consumption and marketing. Enabling policy and policy review from time to time
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not available
Estimated returns	Not available
Gender issues and concerns in development, dissemination, adoption and scaling up	• Land ownership is mainly by men who may have no interest in production of quality seed • Women have limited access to agricultural and extension services hence they might not have adequate knowledge on farmer-saved-seed-system • Women and youth lack finances to buy seed storage materials • Slow information and awareness flow to female farmers due to their low academic levels • Improved training materials and strategies for farmer-saved-seed-system are not favorable to women farmers
Gender related opportunities	• Women and youth to be trained on quality seed under improved farmer-saved-seed-system which they can use to improve production. • Empower women and youth to acquire land • Train women and youth to be lead farmers and part of the ToT teams for training on improved farmer-saved-seed-system • The TIMP has the potential of increasing production, hence improved household food security
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to productive resources such as land, credit, and quality seeds • Training materials and strategies for rice seed may not be favorable for VMGs • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.
VMG related opportunities	• Empower VMGs to acquire land and train them on how to produce quality rice seed under improved farmer- saved-seed system for their use • Train VMGs to be lead farmers and part of the ToT teams for training on production of quality rice seed under improved farmer-saved-seed-system • Target VMGs farms for demonstration on improved farmer-saved-seed-system • The TIMP has the potential of increasing production, hence improved household food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	No documentation
Application guidelines for users	

F: Status of TIMP readiness (1. Ready for upselling; 2. Requires validation; 3. Requires further research	Requires validation
G: Contacts	
Contacts	1. Centre Director, KALRO-Mwea, P.O. Box 298-30100. Kerugoya, Phone: 0202024751, Email: kalro.mwea@kalro.org 2. Deputy Institute Director, KALRO-Mtwapa, P.O. Box 16-80109, Mtwapa, Phone: 0202024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Mwea, KALRO Mtwapa Dr. Ruth Musila
Partner organizations and their roles	NGO and County governments provide advisory services on seed selection under the improved farmer- saved-seed system

2.3.2 Standard Seed System

TIMP Name	**Standard Seed System**
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low rice production, Limited seed supply for farmers
What is it? (TIMP description)	Standard Seed system is community based semi-commercial but an informal seed supply system. Selected farmers or farmer groups are provided basic seed from research stations or formal seed companies and they multiply the seed under the guidance of agricultural staff and KEPHIS seed inspector. The seed does not undergo the full scale of government rigorous certification processes. Only simple standards on crop health and hygiene are adhered to by the seed producers, provided the source of the basic seed is known and therefore traceable. Only 10% of the seed crop by the farmer group is inspected once, at the critical stage such as flowering.
Justification	Small-scale farmers are of the opion that commercial rice seed is highly priced and many times out of their reach. Adoption of Standard seed system for production of rice seed for selected climate smart rice varieties will ensure high yields which are sustainable since quality rice seed will be available at affordable prices by the small-scale farmers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed companies, Seed dealers, Researchers, Extension service, Agripreneurs
Approaches used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days

	• Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability, accessibility and affordability of Standard Seed. • Good marketing models and promotion pathways. Train public and private agricultural service providers on Standard seed production. • Mobilization of farmer producer groups for production of Standard seed. • Funding to support production of basic seed to be used under Standard seed system. • Funding for research, validation and promotion of new climate smart rice varieties to be produced under Standard seed system.
Partners/stakeholders for scaling up and their roles	• KALRO Seeds and interested seed companies-for provision of basic seed of climate smart rice varieties that can be produced under Standard seed. • Well orgarnised community-based rice seed producer groups- Supply of seed • Market players- to create a demand and pull production. • Public and private agricultural extension officers -for supervision of production of Standard seed, awareness and dissemination. • NGOs to organize and mobilize farmer groups and assist them to take up production of quality decalred rice seed as a business. Financing institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be upscaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Low awareness of importance of quality rice seed in most parts of Kenya • Climate smart rice varieties that can be produced under the standard seed system not identified • The agricultural extension officers lack of knowledge and skills to conduct seed inspection. • Unorganized farmer producer groups for seed production.

Suggestions for addressing the challenges	• KALRO Seeds and interested seed companies to identify climate smart rice varieties that can be produced as standard seed and provide their basic seed. • Organize and encourage farmer groups/CIGs/VMGs at community level into production of rice standard seed as a business. • Market players to create a demand and pull production. Identify and train public and private agricultural extension officers for supervision of production of standard seed, awareness and dissemination. • Financing institutions (banks, donors, credit facilitators) for financial credit support
Lessons learned in upscaling if any	• Standard seed allows many farmers to access quality seed of improved rice varieties efficiently and at a cheaper cost than the formal seed sector. • Well-organized farmer producer groups can effectively take up the task of producing standard seed. • Creation of awareness through demonstrations, farmer workshops and media helps in adoption of technologies and innovations. • Availability of market is key
Social, environmental, policy and market conditions necessary for development and upscaling	• Creation of awareness on importance of Standard seed compared to farmer saved seeds. • Registration of CIGs/VMGs producer groups for production of standard seeds. • Harmonious gender and social consideration in research, consumption and marketing. • Enabling policy and policy review from time to time
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not available
Estimated returns	Not available
Gender issues and concerns in development, dissemination, adoption and scaling up	• Land ownership mainly by men who may have no interest in production of standard seed • Women and youth lack funds to engage in seed production • Slow information and awareness flow to female farmers due to low academic levels • Training materials and strategies for the rice standard seed system are not customized to women farmers.
Gender related opportunities	• Empower women and youth to acquire land and connect them to seed companies to became sustainable seed businesses • Train women and youth to be lead farmers and part of the ToT team for training standard seed production • Train women and youth agricultural extension officers as supervisors to supervise production of standard seed • Empower the women and youth who want to produce rice seed by connecting them to financial institutions

VMG issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity and high input use involved in contract rice seed production • Most VMGs do not own land and therefore difficult to be involved in seed production • VMGs have inadequate funds to engage in seed production • Slow information and awareness flow to VMGs farmers due to low academic levels • The rice seed training materials and strategies may not be favorable to VMGs
VMG related opportunities	• VMGs can be organized into producer groups to produce standard rice seed • Empower VMGs to acquire land and connect them to seed companies for sustainable seed businesses • Train VMGs to be lead farmers and part of the ToT team to train in standard seed production • Train agricultural extension officers from VMG communities as supervisors for production of standard seed • Link VMGs interested in rice seed production with financial institutions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Not documented
Application guidelines for users	KEPHIS Seed Certification Guidelines https://kephis.go.ke/seed-certification-plant-variety-protection-services
F: Status of TIMP readiness	
(1-ready for upscaling; 2- requires validation; 3-requires further research)	2 – Requires validation
G. Contacts	
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Deputy Institute Director: KALRO Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization/scientists	KALRO Mwea, KALRO Mtwapa; Dr. Ruth Musila
Partner organizations	Seed Companies, Agro dealers, KEPHIS - Seed Inspection, NGOs and County governments to provide agricultural extension services.

2.3.3 Rice formal seed system

TIMP Name	Rice formal seed system
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	

Problem to be addressed	Low rice production, Limited seed supply for farmers
What is it? (TIMP description)	Formal seed system is the process of producing seed starting from release of varieties, production of early generation seed, and certified seed up to the stage where the farmers can access it through seed merchants for planting. The main stakeholders in formal seed systems include breeders, seed companies, regulators and retailers among others.
Justification	The KALRO and other partners have released many improved climate-smart rice varieties which are not yet commercialized. Strengthening the public-private seed value chain in Kenya is the best option to ensure that majority of the seed companies and merchants are licensed to produce certified seed of improved varieties. Supporting specialized seed companies to produce early generation seed ensures that there is availability and timely production of the certified seed, which will result to increased productivity and production of rice in Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed dealers, Researchers, Extension service, Agripreneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Training - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer-to-farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Innovation platform for interaction of rice seed value chain stakeholders. • A strong public – private rice seed value chain. • License seed merchants for production of certified seeds. • Seed availability, accessibility and affordability. • Good seed system to ensure quality. Good marketing models and pathways. • Public and private agricultural service providers. • Funding for production of early generation seed and certified seed and for promotions.
Partners/stakeholders for scaling up and their roles	• KALRO Seeds for production of early generation seed and licensing to seed companies and merchants • Seed companies and merchants for certified seed production. • Market players to create a demand and pull production. • Farmers/farmer groups to adopt and produce.

	• Involvement of public and private agricultural service providers in promotion and dissemination. • NGOs (e.g. Africa Harvest, Farm Africa) to take up rice farmer organization and mobilization. • Financing institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyanga, Tana River, Taita Taveta, Busia, Kisumu
Counties where TIMP will be upscaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Lack of innovation platforms to facilitate interaction among rice seed value chain stakeholders. • Unwillingness of seed companies to commercialize seed of KALRO rice varieties. • Farmers' unwillingness to buy certified seed. • Low awareness of the importance of improved rice varieties in some parts of Kenya
Suggestions for addressing the challenges	• Establish innovation platforms for rice seed value chain • Establish demonstration to display new improved varieties for seed companies to identify candidates for commercialization. • Strengthen public – private rice seed value chain by licensing seed companies and merchants to produce certified seed of KALRO released varieties • Strengthen KALRO Seeds to produce early generation seed • Ensure availability and accessibility of affordable certified rice seed • Well organized rice seed farmer producer groups and networks. • County and central government support • Develop good policies for the rice seed production and marketing • Funding for research, validation and promotion of new rice varieties and seed production
Lessons learned in upscaling if any	• Creation of awareness through demonstrations helps seed companies identify and pick the best climate-smart rice varieties for the production of certified seed. • Availability of market is key
Social, environmental, policy and market conditions necessary for development and upscaling	• A strong innovation platform for the rice seed value chain is key. • MOU between KALRO and willing seed companies/merchants for production of certified seed. • Harmonious gender and social consideration in rice seed production and marketing.

	• Farmer producer organizations for rice seed production
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of Seed
Estimated returns	Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in contractual rice seed production is not favourable for women who are already overburdened • Land ownership mainly by men who may have no interest in contract rice seed production • Women and youth may not have the required finances for rice seed production
Gender related opportunities	• Women and youth can be organized into producer groups for formal seed production • Empower women and youth to acquire land and connect them to seed companies to become sustainable seed businesses • Train women and youth to be lead farmers part of the ToT team for training rice seed contract farmers • Empower the women and youth who want to produce rice seed by connecting them to financial institutions
VMG issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity and high input use involved in contract rice seed production • Most VMGs do not own land and therefore difficult to be involved in contact rice seed production • VMGs lack funds for contact rice seed production • Slow information and awareness flow to VMGs farmers due to low academic levels • The rice seed training materials and strategies may not be favorable to VMGs farmers
VMG related opportunities	• VMGs can be organized into producer groups for rice seed production • Empower VMGs to acquire land and connect them to seed companies to became sustainable seed businesses • Train VMGs to be lead farmers and part of the ToT team for training contract farmers for rice seed production • Empower the VMGs who want to produce rice seed by connecting them to financial source
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Production of certified seed for NERICAs and Komboka by KALRO Seeds Mwea
Application guidelines for users	Musila R.N et al., (2023). Certified rice seed production for Kenya.
F: Status of TIMP readiness	
(1-ready for upscaling; 2-requires validation; 3-requires further research)	1 - Ready for upscaling;

G. Contacts	
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Deputy Institute Director: KALRO Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization/scientists	KALRO Mwea, KALRO Mtwapa; Dr. Ruth Musila
Partner organizations	Seed Companies, Agro dealers, KEPHIS - Seed Inspection, NGOs and County governments to provide agricultural extension services.

2.4 FOOD SAFETY MANAGEMENT SYSTEM

2.4.1 Good Agricultural Practices (GAPs) for Rice

TIMPs name	**Good Agricultural Practices (GAPs) for Rice**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Declining food safety, Reduced food quality, Poor farming practices
What is it? (TIMP description)	GAPs is a systematic process of implementing a standardized production system globally designed to reassure consumers about how food and cash crops are produced and handled at the farm. It is not about a specific crop production but the entire process through which production takes.
Justification	GAPs is based on the principals of risk prevention, risk analysis, sustainable agriculture (by means of Integrated Pest Management (IPM) and Integrated Crop Management (ICM) to continuously improve rice farming systems. It is of utmost importance in protecting personal health and It requires ensuring safety throughout the rice crop value chain. It must be compulsory and transparent and operate not only from the farm level but also upstream to include suppliers (e.g. fertilizers, plant protection) and all rice value chain players including providers of logistics and farm equipment.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice producers, Public/private extension providers, Processors, Transporters, Traders, Agripreneurs

Approaches to be used in dissemination	• Sensitization meetings with stakeholders along the rice value chain (Farmers, processors, traders, service providers, extension workers) • Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Training - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer-to-farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Policy support from the government on the safe use of Plant Protection Products (PPP's) in rice value chain. • Participatory on-farm demonstrations by stakeholders • Collaboration among value chain actors consisting of researchers, processors, lead farmers, partners and regulatory institutions (KALRO, IRRI, MoALD, KEPHIS, KEBS and County Governments) • Good marketing models and pathways
Partners/stakeholders for scaling up and their roles	• MoALD- Policy guidelines and regulations • Producer organizations, NGO's- Capacity building and promotion • Private extension providers, CoG and other value chain players- Public sensitization and dissemination of information
C: Current situation and future scaling up	
Counties where already promoted, if any	Not yet
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Lack/inadequate knowledge on the benefits GAPs • Lack of legislative mechanisms to support the GAPs, in particular the domestic scope • The perception that GAPs is oppressive rather than supportive
Recommendations for addressing the challenges	• Continuous training of farmers, extension staff and other value chain players • Involve rice stakeholders in Influencing policy change through advocacy • Sensitization of value chain actors and stakeholders
Lessons learned in upscaling, if any	The low number of stakeholders aware of GAPs

Social, environmental, policy and market conditions necessary	• Supportive policy of national and county governments to promote adaption of GAP's. • Value chain actors willing to adapt to GAPs for consumer safety. • Environmental and health safety applied in all levels of rice value chain • Increased market demand for rice and value addition products
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination adoption and scaling up,	• Women have less access to agricultural information, technology and knowledge on GAPs. • Women have limited access to education, training and extension services on GAPs. • Most small scale production systems are centered on women and hence it's them who suffer from the detriments of poor practices. • The improper application of pesticides results in more women suffering from complications than the men in small-scale holdings. This means that adaption of GAPs will increase the benefits of good health to the women and those who work more on the farm.
Gender related opportunities	• Due to the systematic method of the processes employment opportunities exist for youths in performing the task of GAPs • Proper application of GAPs will lead to improved health of the various gender categories due to the consumption of clean health rice that is free from hazards
VMG issues and concerns in development, dissemination, adoption and scaling up	• Requires a lot of movement on the farm to maintain records and process verification which may be untenable by some VMGs who are elderly and disabled. • VMGs have limited access to education, training and extension services on GAPs. • VMGs have less access to agricultural information, technology and knowledge on GAPs.
VMG related opportunities	• Employment opportunities for VMGs exist in performing the task of GAPs • Proper application of GAPs will lead to improved health of the various gender categories due to the consumption of clean health rice that is free from hazards. • There will be enhanced productivity of smaller parcels of land to the advantage of youth who normally have no access to larger parcels.
E: Case studies/profiles of success stories	

Success stories from previous similar projects	
Application guidelines for users	GOK (2021). The National Food Safety Policy. https://kilimo.go.ke/wp-content/uploads/2022/02/Draft-Food-Safety-Policy-2021.pdf
F: Status of TIMP readiness (1. Ready for upselling; 2. Requires validation; 3. Requires further research	Ready for upscaling
G: Contacts	
Contacts	• Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org • Centre Director, KALRO FCRI - Njoro Private Bag (20107) Njoro Tel: 020-3510865. Email: kalro.njoro@kalro.org
Lead organization and scientists	KALRO: Ndung'u, J.N, Musila, R., Wasilwa, L. and Kirigua, V.
Partner organizations	MoALD, AFA, FPEAK, PCPB, AAK, KEPHIS, CoG, NGO's and Universities.

2.4.2 Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for Rice Value Chain in Kenya

2.4.2 TIMP Name	**Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for Rice Value Chain in Kenya**
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Health hazards due to chemical and biological contamination
What is it? (TIMP description)	Food safety management system (FSMS) through Hazard Analysis and Critical Control Point (HACCP) in rice is a system of food safety monitoring and control based on the systematic identification and assessment of various hazards. It is a preventive, rather than a reactive tool that places the protection of the rice supply chain from biological, chemical and physical hazards into the hands of food management systems. The HACCP system is designed to minimize the risk of food safety hazards by identifying them, establishing controls and monitoring these controls. When HACCP concept is applied in the rice value chain, a wholesome and safe rice supply can be maintained improving on trade and health within and without Kenya borders.

Justification	The only important tool kit to assure food safety through monitoring in the rice value chain is the Hazard Analysis and Critical Control Points (HACCP) system. This critical tool is already incorporated into the Codex Alimentarius of the world as well as into the national public health food safety legislations of Kenya. This HACCP approach can be applied to all stages of the rice value chain process, ranging from production to processing, transportation and retail in commercial establishments. Through its application, food safety charts in the rice value chain will easily be identified through critical control points. The key elements will be identified that will be used or modified to reduce hazards formation in all steps of rice production to consumption.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Processors, Transporters, Traders, Service providers, Extension workers and Agripreneurs
Approaches used in dissemination	• Sensitization meetings with stakeholders along the rice value chain (Farmers, processors, traders, service providers, extension workers) • Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Policy support from government on safe use of Plant Protection Products (PPP's) on rice value chain. • Distribution of the printed HACCP plan to rice value chain actors for implementation in order to reduce hazards • Form a working team consisting of rice value chain actors, including among others; HACCP specialist, food scientist, microbiologis, quality control and safety specialist from the Kenya Bureau of Standards and county health officers to ensure sensitization and implementation • Participatory on-farm demonstrations by stakeholders • Collaboration among value chain actors consisting of researchers, processors, lead farmers, partners and regulatory institutions (KALRO, IRRI, MoALD, KEPHIS, KEBS and County Governments)
Partners/stakeholders for scaling up and their respective roles.	• Institutions with IPM and ICM programs • MoALD, KEBS and other institutions responsible for legislating in food safety, regulations and sale of pesticides • Institutions with the required analytical testing

	• Training institutions with extension programs to producers and other actors on the chain • Producers and exporters associations. • Processors and local traders
C: Current situation and future scaling up	
Counties where already promoted. if any	• Not promoted in any county of Kenya
Counties where TIMPs will be up scaled	• All counties growing and processing rice in Kenya.
Challenges in development and dissemination	• Inadequate funds to reach value chain actors • Lack/inadequate knowledge on HACCP principles • Lack of legislative mechanisms to support the GAPs, in particular the domestic scope
Suggestions for addressing the challenges	• Funding of dissemination platforms • Continuous training of value chain actors (Researchers,farmers, Processors,extension staff and other value chain players) and Sensitization of value chain actors and stakeholders • Involve rice stakeholders in influencing policy change through advocacy • Sensitization of value chain actors and stakeholders
Lessons learned in upscaling, if any	• The value chain of rice in Kenya is willing to adopt the HACCP plan if well engaged.
Social, environmental, policy and market conditions necessary for development and up-scaling	• The policies and laws in public health in place in Kenya are supportive to the use of HACCP Plan in rice value chain. • Value chain actors willing to apply the HACCP principles • Environmental and health safety applied in all levels of rice value chain • Increased market demand for rice and value addition products
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination adoption and scaling up,	• Women have less access to agricultural information, technology and knowledge on HACCP. • Women have limited access to education, training and extension services on HACCP. • Most small scale production systems are centered on women and hence it's them who suffer from the detriments of poor practices. The improper application of pesticides results in more women suffering from complicationss. This means that adaption of GAPs will increase the benefits of good health to the women and those who work more on the farm.

Gender related opportunities	• Due to the systematic method of the processes employment opportunities exist for youths in performing the task of HACCP • Proper application of HACCP will lead to improved health of the various gender categories due to consumption of clean health rice that is free from hazards
VMG issues and concerns in development, dissemination, adoption and scaling up	• Requires a lot of movement on the farm to maintain records and process verification which may be untenable by some VMGs who are elderly and disabled. • VMGs have limited access to education, training and extension services on HACCP. • VMGs have less access to agricultural information, technology and knowledge on HACCP.
VMG related opportunities	• Employment opportunities for youths exist in performing the task of HACCP • Proper application of HACCP will lead to improved health of the various gender categories due to consumption of clean health rice that is free from hazards. • There will be enhanced productivity of smaller parcels of land to the advantage of youth who normally have no access to larger parcels.
○ **E: Case studies/profiles of success stories**	
Success stories	
Application guidelines for users	GOK (2021). The National Food Safety Policy. https://kilimo.go.ke/wp-content/uploads/2022/02/Draft-Food-Safety-Policy-2021.pdf
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	• Ready for upscaling
○ **G: Contacts**	
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Centre Director, KALRO FCRI - Njoro Private Bag (20107) Njoro Tel: 020-3510865. Email: kalro.njoro@kalro.org
Lead organization and scientists	KALRO: Ndung'u, J.N, Musila, R., Wasilwa, L. and Kirigua, V.
Partner organizations	MoALD, AFA, FPEAK, PCPB, AAK, KEPHIS, County governments, NGO's and Universities.

2.4.3 Aflasafe KE01^{TM} for Upland and rainfed lowland rice

TIMPs name	Aflasafe KE01^{TM} for Upland and rainfed lowland rice
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Aflatoxin contamination of rice before harvesting
What is it? (TIMP description)	It is a pre-harvest bio-control agent that reduces aflatoxin contamination in some crops by 80-99% at harvest and in storage. It is applied preharvest but has postharvest benefits. Aflasafe is mainly roasted sterile sorghum (99.7% of the product), coated with four atoxigenic (i.e. non-poisonous producing) types of *A. flavus* native in Kenya. To avoid confusion with sorghum for food, Aflasafe is dyed blue using food color. Aflasafe is broadcast by hand 2-3 weeks before flowering at the rate of 10 kg/ha (4 kg/acre). The friendly Aflasafe fungi grow out and eliminate the aflatoxin producing types of *A. flavus*. Hence, rice at harvest will have reduced levels of aflatoxins
Justification	Aflatoxin contamination in rice is a serious food safety concern and with dire public health consequences, including death if contaminated rice is consumed. Aflasafe is a natural pre-harvest biocontrol product that reduces aflatoxin contamination in rice and other cereals by 80-99% at harvest and in storage.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Processors, Seed merchants, Researchers, Agriculture service providers, Traders,Agripreneurs
Approaches to be used in dissemination	• Sensitization meetings with stakeholders along the rice value chain (Farmers, processors, traders, service providers, extension workers) • Sensitization foras with policy makers and influencers • Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• A platform for interaction of rice value chain stakeholders • Following good harvest and postharvest practices • Participatory implementation, stakeholder capacity building and networks

	• Availability of Aflasafe closer to farmers by enhancing distribution networks, e.g. using agro-dealers.
Partners/stakeholders for scaling up and their roles	• Farmers – for activity implementation and promotion, Extension service (public and private) – technology transfer and dissemination • Researchers (KALRO) – for manufacturing Aflasafe KE01 at the KALRO-Katumani factory; establishment of demonstration plots, capacity building of county stakeholders, extension workers and farmers • International Institute of Tropical Agriculture (IITA) – backstopping KALRO during upscaling the aflasafe to other rice growing areas. • Also testing efficacy of aflasfe in other crops which are prone to contamination with aflatoxin. • Private sector – Koppert Biological Systems, for distributing aflasafe to farmers. • Agro-dealers – working with Koppert Biological Systems to ensure Aflasafe is available at farmers' reach, especially in rural areas. • CIGs play the role of adoption of the technologies through their various groups. • VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies.
C: Current situation and future scaling up	
Counties where already promoted, if any	Not yet
Counties where TIMP will be up scaled	Counties in Kenya where rice is produced
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders. • Lack of stakeholder forums to sensitizing farmers on Aflasafe KE01 • Inadequate resources and extension agents to train farmers on Aflasafe KE01 • Limited information materials on control of flatoxin contamination using Aflasafe KE01 • Perception that Aflasafe KE01 not available in the market hinders dissemination
Recommendations for addressing the challenges	• Eastablish rice innovation platforms to enhance stakeholder interaction. • Establishe stakeholder forums to sensituize farmers on Aflasafe KE01. • Involve County Extension agents in Sensitization and training • Involve all partners in developing extension materials • KALRO is partnering with Koppert Biological Systems for distribution of Aflasafe to farmers. Koppert Biological Systems, on the other hand, is partnering with

	agro-dealers to ensure Aflasafe is available close to farmers.
Lessons learned in upscaling, if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform. • Involvement of stakeholders and private sector such as CIG, CBOs and agrovets enhances adoption Continuous capacity building is key to attitude change. • Consistent trainings, demonstrations and sensitizations would motivate farmers to adopt the technology. • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Adopting public-private-partnerships, so that the private sector (e.g. NGOs and agrovets) can provide the aflasafe closer to rice farmers • Capacity building of farmers on use of aflasafe on rice • Aflasafe KE01 is environment friendly and does not contamination
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 201 per kg
Estimated returns	Aflasafe KE01TM reduces aflatoxin contamination of cereals like maize by 80- 99% at harvest and storage which can also apply to rice. This also means reduced health costs for treating aflatoxin poisoning in the population. The savings in the health sector can be used in other sectors of the economy.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth may also have limited access to Aflasafe information as compared to men. because they may not be able to participate in sensitization fora • Women have limited access to education, training and extension services as compared to men
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to Aflasafe information because they may not be able to participate in sensitization fora • VMGs may also have limited access to finances to buy the required resources such as Aflasafe • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit.

	• Opportunity for youth and women to venture into business of distributing Aflasafe to farmers (as stockists and agro-dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Not yet done on rice
Application guidelines for users	1. Ali, A. (2019). Aflatoxins in rice: Worldwide occurrence and public health perspectives. Toxicology Reports, 6: 1188-1197 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6872864/pdf/main.pdf 2. Technical policy papers.- https://aflasafe.com/resources/technical-policy-papers/
F: Status of TIMP readiness (1. Ready for upscalling; 2. Requires validation; 3. Requires further research	1. Ready for upscaling 3.Requires further research (as work not done on rice)
G: Contacts	
Contacts	1. Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org 2. Centre Director, KALRO FCRI - Njoro Private Bag (20107) Njoro Tel: 020-3510865. Email: kalro.njoro@kalro.org
Lead organization and scientists	KALRO: Ndung'u, J.N, Musila, R., Wasilwa, L. and Kirigua, V.
Partner organizations and their roles	IITA, Koppert Biological Systems, Agro-dealers, MOALD, NGOs, CBOs

2.5 AGRONOMIC PRACTICES

2.5.1 Timely and appropriate land Preparation

2.5.1 TIMP NAME	Timely and appropriate land Preparation
	 *Land Preparation:Photo credit, Oyange*.

Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss resulting from untimely and inappropriate land reparation in rice fields
What is it? (TIMP description)	This is the clearing and tilling of fallow fields or stubble from previous harvest in good time, in readiness for planting. This is done using either herbicides or ploughing, or a combination of both. It is recommended to prepare land about 15 days before planting.
Justification	Late land preparation results in poor crop establishment with consequent loss in yields. Timely land preparation ensures a well-prepared, level field that produces consistent, healthy crops that can out compete weeds, increase water use efficiency, and produce high yields at lower costs. In addition, direct seeding timely prepared land in rain fed rice, leads to increased germination rate and uniform crop establishment.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Researchers, Agricultural service providers, Extension officers
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of extension agents familiar with local dialects of target areas • Availability of extension agents to train farmers during rice cropping calendar • Availability of the various land preparation equipment • Availability of labour required for in implementation
Partners/stakeholders for scaling up and their roles	• National Irrigation Authority- Technical support • Farmer cooperatives – to mobilise farmers • Extension agents – to facilitate the training • KALRO – provide the raining and backstopping • Existing farmer groups – for uptake and dissemination od the practices
C: Current situation and future scaling up	
Counties where already promoted, if any	Kirinyaga, Kisumu, Busia, Siaya
Counties where TIMP will be upscaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale,

	Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Inadequate funding to reach all target areas • Inadequate personnel to reach all target beneficiaries • Inadequate extension services/real time decision support systems to provide guidance to farmers.
Recommendations for addressing the challenges	• Mobilisation and availing of resources by county and national governments • Engagement and deployment of adequate personnel to adequately cover target beneficiaries • Real time advisory methods through extension and ICT included technologies
Lessons learned in upscaling, if any	Timely land preparation has potential to increase rice yield potentially and hence embracing it with necessary technologies is vital
Social, environmental, policy and market conditions necessary for development and upscaling	• The management practice is socially acceptable • Climate, soils and terrain is conducive for the various land preparation methods to be applied • Enabling policy environment for implementation of the TIMP • Market will be able and willing to absorb the extra produce
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 6500/= per acre
Estimated returns	Estimated returns with land preparation is 6-8 bags of rice per acre @7000 = 42000
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have less access to land - so they have to rely on their husbands to select and apportion land for rice cultivation • Women have less access to agricultural information, technology and knowledge. • Women and youth have less access to credit to purchase/hire the required inputs/equipment/labour. • Women have limited access to education, training and extension services.
Gender related opportunities	• Affirmative action fund opportunities such as the women and youth enterprise fund exist for them to access the required finances
VMG issues and concerns in development, dissemination, adoption and scaling up	• Some VMGs such as women have less access to land - so they have to rely on their husbands to select and apportion land for rice cultivation • Timely land preparation will ease VMGs work burden especially during transplanting, broadcasting weeding and harvesting. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • VMGs have limited access to education, training and extension services.
VMG related opportunities	• Affirmative action fund opportunities for VMGs exist for them to access the required finances.

E: Case studies/profiles of success stories	
Success stories if any	
Application guidelines for users	• Kega, V. M., Gikonyo, E. W., Muriithi, C. W., Macharia, J. M. K., & Muthoni, L. (2015). Rice cultivation manual. Kenya Agricultural and Livestock Research Organization, 63. • http://www.knowledgebank.irri.org/images/docs/12-Steps-Required-for-Successful-Rice-Production.pdf?pdf
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research**)**	1- Ready for upscaling
G: Contacts	
Contacts	1. Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 2. Center Director KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa Phone: 020 2024751 Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO; Oyange W.A.
Partner organizations	National Irrigation Authority(NIA), Agriculture Food Authoriy(AFA)

2.5.2 Rice variety Selection

2.5.2 TIMPS NAME	**Rice variety Selection**
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	• Low rice yields (Average yield attainment of 3 – 4 tonnes per hectare against global yield of 8 tonnes per hectare resulting from mismatch of varieties with the environment and susceptibility of planted varieties to pests and diseases. • Low market prices due to planting of non-preferred varieties.
What is it? (TIMP description)	This is the deliberate decision to select to plant a particular variety or varieties from a variety of options due to their preffered traits such as higher yields, higher quality, preference by market, suitability to the environment and pest/disease tolerance among others.

Justification	Planting of inappropriate varieties results in loss of yields and/or loss of market. Rice varieties are site and market specific, with some varieties being adaptable to multiple environments and enjoying preference across different markets. Selection of the right variety ensures suitability of the planted variety to the environment, resulting in high yields, quality and assured crop and market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed Agro-dealers, Researchers, Agricultural service providers.
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of guiding platform either through the extension officers, • Availability of funds for promotion activities • Availability of extension agents familiar with the local dialects of target promotion areas • Availability of the alternative rice varieties • Awareness of the current varieties released by the research institutions.
Partners/stakeholders for scaling up and their roles	• National Irrigation Authority (NIA),- Technical support • Farmer cooperatives – mobilization of farmers • Seed Agro- dealers – availability of seed • KALRO (research Institutions) – Availability of alternative rice varieties • Existing farmer groups - mobilization of farmers • Extension agency bodies – facilitation of farmer training
C: Current situation and future scaling up	
Counties where already promoted, if any	Kirinyaga, Kisumu, Busia and Kwale
Counties where TIMP will be upscaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• Unavailability of Quality hybrid rice seed at planting • Lack of cooperatives for farmers to receive training in organized forums • Lack of partnership between seed agro-dealers and research stakeholders for technology development and transfer of hybrid rice quality seeds

	• Inadequate funding for dissemination activities
Recommendations for addressing the challenges	• Timely availability of seed material • Research organization producing quality seeds to partner with private companies to create awareness • Formation of farmer groups to pool resources together to obtain high quality seeds • Collaboration among institutions for knowledge transfer.
Lessons learned in upscaling, if any	Farmers need persistent demonstration trials on different rice varieties for them to adopt
Social, environmental, policy and market conditions necessary for development and upscaling	• The alternative varieties will be socially acceptable to the target communities. • Climate, soils and terrain will be conducive for the plant growth during period of upscaling • Enabling policy environment for development varieties and upscaling of the TIMP • Market will be able and willing to absorb the extra produce
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 1500-1800 per acres
Estimated returns	KES 162,500/= to 234750/= per acre (2500-3750 kg paddy/acre @ KES 65/kg)
Gender issues and concerns in development,dissemination, adoption and scaling up	• Women and youth have limited access to land for quality seed planting. • Women and youth have less access to credit to purchase the required inputs such as quality rice seeds. • Women and youth have limited access to education, training and extension services in rice production • Women have less access to agricultural information, technology and knowledge.
Gender related opportunities	• Employment opportunities exist for men/women to select quality seed rice production • Opportunities such as the affirmative action funds exist for women and youths to access credit to rent land for seed bulking activity.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs may also have limited access to finances to buy the required inputs such as high quality seeds.
VMG related opportunities	• Employment opportunities exist for some VMGs to perform the task of quality seed production • Opportunities such as the affirmative action funds exist for some VMGs such as women and youths to access credit to rent land for quality seed production
E: Case studies/profiles of success stories	

Success stories from previous similar projects	Trials demonstrated 2500 -3750 kg paddy/acre from improved varieties planted in the recommended environment compared to 1040 - 1250 kg/acre of unimproved seed
Application guidelines for users	Kega, V. M., Gikonyo, E. W., Muriithi, C. W., Macharia, J. M. K., & Muthoni, L. (2015). Rice cultivation manual. Kenya Agricultural and Livestock Research Organization.
F: Status of TIMP readiness (1-ready for upscaling; 2-requiresvalidation; 3-requires further research	1- Ready for upscaling
G: Contacts	
Contacts	1. Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 2. Center Director: KALRO-Mtwapa P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751 Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Oyange W.A.
Partner organizations	National Irrigation Authority, Agriculture Food Authority

2.5.3 Nursery establishment

2.5.3 TIMPS NAME	**Nursery establishment**
	 *Rice nurseries*
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low yields arising from poor crop establishment under direct seeding
What is it? (TIMP description)	This is the planting and nurturing of rice seed in a nursery, for later transplanting in the field at the appropriate time.
Justification	Most available rice varieties establish poorly when seeded directly into the field. This leads to poor yields. Transplanting of rice

	seedlings form nursery ensures better establishment from the healthy and vigorous seedlings. This results in higher crop yields and reduced seed rate (up to 50% less than direct seeding), thus less cost of seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Research scientists, Extension agents, Cooperatives, MoALD
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of fund for promotion activities and inputs • Requirements for sterilization mechanism to prevent pests and disease survival • Availability of hybrid seeds which are expensive in acquisition and hence need to attain optimum plant population
Partners/stakeholders for scaling up and their roles	• County government extension services - Provide link with farmers. • National Irrigation Authority (NIA)- Technical Support • Kenya Plant inspectorate services (KEPHIS) - ensure availability of only certified seed • Farmer groups- Mobilisation of farmers • Farmer cooperatives - Mobilisation of farmers
C: Current situation and future scaling up	
Counties where already promoted, if any	Kirinyaga, Kisumu, Busia
Counties where TIMP will be upscaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta, Kwale
Challenges in dissemination	• Requires technical capacity to guide in production • Lack of adequate resources for dissemination activities and materials • Inadequate trained personnel familiar with the local dialects in target ares
Recommendations for addressing the challenges	• Build technical capacity in hi-tech commercial nursery propagation • Allocation and prioritization of funds for dissemination activities

	• Engage and build capacity of agents familiar with the local dialects
Lessons learned in upscaling, if any	Timely and efficient nursery establishment improves the yield potential of rice varieties and thus leading to more rice yield to the market through optimization of resources.
Social, environmental, policy and market conditions necessary	• The management practice is socially acceptable, especially to the youth who are the most likely implementors • Climate, soils and terrain is conducive for setting up and maintenance of nurseries • Enabling policy environment for implementation of the setting up nurseries • Market will be able and willing to absorb the extra produce
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not costed
Estimated returns	Not yet determined
Gender issues and concerns in development ,dissemination, adoption and scaling up	• Women and youth have limited access to land for rice nursery management. • Women and youth may also have limited access to finances to buy the required inputs such as seeds. • Women and youth may have less access to credit • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles
Gender related opportunities	• Employment opportunities for youths exists in transportation of seedlings to the rice fields. • The technology is acceptable and easy to upscale • Opportunities for youths and women exists in rice production , and marketing nursery seedlings as a commercial activities.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs has limited access to land rice nursery establishment compared to men. • VMGs may also have limited access to finances to buy the required inputs such as seeds and nursery planting materials • VMGs have less access to agricultural information, technology and knowledge.
VMG related opportunities	• Affirmative action in various areas as for instance in the provision of finances to VMGs • Increased production will lead to increased consumption and utilization of rice in the urban areas and rural areas.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Research trials have demonstrated poor establishment and higher seed rate under direct seeding in flooded rice production

Application guidelines for users	Kega, V. M., Gikonyo, E. W., Muriithi, C. W., Macharia, J. M. K., & Muthoni, L. (2015). Rice cultivation manual. Kenya Agricultural and Livestock Research Organization, 63.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	1. Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 2. Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO; Oyange W.A.
Partner organizations	Agriculture Food Authority(AFA), MoALD, KEPHIS, Seedlings producers

2.5.4 Transplanting

2.5.4 TIMPS NAME	**Transplanting**
	 *Transplanted rice seedlings (Source: Wasilwa, L.)*
Category (i.e. technology, innovation or management practice)	Management Practices
A: Description of the technology, innovation or management practice	
Problem addressed	Low yields due to poor plant establishment in direct seeding.
What is it? (TIMP description)	Transplanting is the field planting of rice seedlings that have been established and raised in a nursery. It results in higher yields and less weeding. Transplanting can either be manual or mechanized.
Justification	Direct seeding of rice often leads to poor crop establishment due to low field germination of rice seed. Raising seed in the nursery ensures the planting of rice seedlings that will establish and grow into mature crop. This results in high yields due to a good crop stand which enables the realization of the planted rice variety's yield potential.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Farmers, Research scientists, Extension personnel, Cooperatives, MoALD
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of essential required resources such as wet-mat technology/trays • Availability of hybrid seeds which are expensive in acquisition and hence need to attain optimum plant population. • Availability of labour for transplant and transplanting
Partners/stakeholders for scaling up and their roles	• County government extension services; Provide link with farmers. • National Irrigation Authority (NIA) – Provide technical support • Kenya Plant inspectorate services (KEPHIS) – to ensure availability of only certified seed • Commercial hi-tech nursery propagators – to avail seedling planting materials • Community Interest Groups (CIGs) – to mobilise farmers for uscaling • Farmer cooperatives – to mobilise and aggregate farmers
C: Current situation and future scaling up	
Counties where already promoted, if any	Kirinyaga, Kisumu, Busia
Counties where TIMP will be upscaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West Pokot
Challenges in dissemination	• Requires technical capacity to guide in production of healthy seedlings • Inadequate funding to reach all target areas • Inadequate personnel to reach all target beneficiaries • Inadequate extension services/real time decision support systems to provide guidance to farmers
Recommendations for addressing the challenges	• Build technical capacity in hi-tech commercial nursery propagation • Mobilization and availing of resources by county and national governments

	• Engagement and deployment of adequate personnel to adequately cover target beneficiaries • Real time advisory methods through extension and ICT included technologies
Lessons learned in upscaling, if any	• Timely transplanting of healthy and vigorous seedlings improves realization of the yields potential of rice varieties and thus leading to more rice yield to the market through optimization of resources. • Transplanting saves costs of seed by 25-40%
Social, environmental, policy and market conditions necessary for development and upscaling	• Transplanting is socially acceptable in the target communities. • Environmental conditions is favourable for crop growth during upscaling activities for transplanting of rice. • Policy environment is enabling for upscaling of the management practice • The market demand can absorb the extra produce arising from the increased yields.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 9000/= per acre
Estimated returns	KES 162,500/= to 234750/= per acre (2500-3750 kg paddy/acre @ KES 65/kg)
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth may have less access to credit • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic
Gender related opportunities	• The technology is acceptable and easy to upscale by both males and female gender • Opportunities for youths and women exists in rice production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation. • VMGs may also have limited access to finances to buy the required inputs such as seeds. • VMGs have less access to agricultural information, technology and knowledge.
VMG related opportunities	• Affirmative action in various areas as for instance in the provision of finances to VMGs • Increased production will lead to increased consumption and utilization of rice and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories if any	None
Application guidelines for users	Kega, V. M., Gikonyo, E. W., Muriithi, C. W., Macharia, J. M. K., & Muthoni, L. (2015). Rice cultivation manual. Kenya Agricultural and Livestock Research Organization, 63.

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	1. Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 2. Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org 3. KALRO Call centre: 2541110100
Lead organization and scientists	KALRO; Oyange W.A.
Partner organizations	Agriculture Food Authority (AFA), MoALD, KEPHIS, Seedlings producers

2.5.5 Direct Seeding

2.5.5 TIMPs name	**Direct seeding**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	• Loss of crop due to late maturing • High cost of labour associated with planting of seedlings, particularly in rainfed rice production
What is it? (TIMP description)	This is direct planting of rice seed into the field soil as opposed to planting and nurturing in the nursery. This can be done by dry or wet seeding. Dry direct seeding method is usually practiced for rainfed and deepwater ecosystems. Seed is sown onto dry soil surface, then incorporates the seed either by plowing or harrowing.The methods for direct planting include: • Dribblin method seed is dribbled into furrows and covered using a spike-tooth harrow • Drilling method seed is precisely placed at predetermined depth, into the soil using special equipment. • Wet direct seeding method seed is drilled into the soil, in wet fields, using a drum seeder.
Justification	Direct seeding method saves on rice farming costs such as labour and time spent in establishing nurseries. It enable the utilization of 100% of all the rice land hence increasing the area production.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Farmers, Research scientists, extension agent, cooperatives, MoALD
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of technical capacity to manage weeds from competing with the rice crops • Availability of traditional rice seeds that are not expensive and can establish well. • Availability of equipment to cultivate the land to fine tilth to avoid clods that can limit seed from germination
Partners/stakeholders for scaling up and their roles	• County government extension services-provide link with farmers. • National Irrigation Authority (NIA)- technical support • Kenya Plant inspectorate services (KEPHIS)- ensure availability of only certified seed • Farmer groups- Mobilisation of farmers • Farmer cooperatives- Mobilisation of farmers
C: Current situation and future scaling up	
Counties where already promoted, if any	Kirinyaga, Kisumu, Busia
Counties where TIMP will be upscaled	Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• Inadequate funding to reach all target areas • Inadequate personnel to reach all target beneficiaries • Inadequate extension services/real time decision support systems to provide guidance to farmers.
Recommendations for addressing the challenges	• Build technical capacity in hi-tech commercial nursery propagation • Farmers to form group and work together as it has been in the past aggregation of production resources • Credit facilities to structure their loan plans to accommodate smallholder farmers to buy machines such as drum or driller • Extension services and digital technology for information sharing on weather forecast.

Lessons learned in upscaling, if any	Direct seeded rice have more competition from weeds.
Social, environmental, policy and market conditions necessary	• Seeding is socially acceptable • Environmental conditions will be favourable for crop growth during upscaling activities for direct seeding of rice • Policy environment is enabling for upscaling of the management practice • The market demand will absorb the extra produce arising from the increased yields.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 5000/= per acre
Estimated returns	KES 162,500/= to 234750/= per acre (2500-3750 kg paddy/acre @ KES 65/kg)
Gender issues and concerns in development ,dissemination, adoption and scaling up	• Planting using the recommended spacing will ease women's work burden during farm operation such as weeding and harvesting • Women have less access to agricultural information, technology and knowledge. • Women have limited access to education, training and extension services
Gender related opportunities	Employment opportunities exist for women in planting using the recommended spacing to attain optimum plant population
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services
VMG related opportunities	• Employment opportunities exist for women in planting using the recommended spacing
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Kirinyaga, Kisumu
Application guidelines for users	Africa Rice Centre Growing upland rice: a production handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	Ready for upscaling
G: Contacts	
Contacts	1. Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 2. Center Director KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa

	Phone: 020 2024751 Email: kalro.mtwapa@kalro.org 3. KALRO Call Centre 254 0111010100
Lead organization and scientists	KALRO; Oyange W.A.
Partner organizations	Agriculture Food Authority (AFA), MoALD, KEPHIS,

2.5.6 Fertilizer application

2.5.6 TIMP Name	Fertilizer application
	 *Application of fertilizer in the rice field*
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yield due to inadequate nutrients in the soil
What is it? (TIMP description)	This is the application of fertilizer to rice crop to replenish the soil nutrients for crop uptake. The rates applied shall depend upon soil nutrient status or site specific recommendations
Justification	Low yields are in rice when there is no additional application of fertilisers. This is due to the low soil nutrient status in rice paddies of Kenya. These soils are generally low in N, P K, Zinc and Boron. Judicious application of fertilizer ensures sustainable higher rice yields.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice farmers, National Irrigation Authority (NIA), community irrigation schemes, research scientists, extension agents, farm input stockists
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Training - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer-to-farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability, affordability and accessibility of fertilizers in agro-dealers stores • Development and availability of technical recommendations on fertilizer use • Stakeholders mobilization and sensitization
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization • NIA- Provision of primary irrigation infrastructure • IWUA- Farmer mobilization and sensitization • Farmers- scale up the technology

	• Agro-input dealers- fertilizer input supply • Development partners – to provide support on capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Siaya, Busia,Taveta, Kwale, Homabay, Migori
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers • Inadequate extension staff
Suggestions for addressing the challenges	• Community or target audience mobilization and clarification of any issues. • Anticipate likely barriers to dissemination and address them • Develop easy-to-understand information packages for farmers. • Promote use of e-extension
Lessons Learnt in upscaling if any	Use of appropriate fertilizer regimes has significant increase in rice yields
Social, environmental, policy and market conditions necessary for development and upscaling	• Fertiliser application will be socially acceptable (particularly to the women and youth who form the labour force in rice production) in the target communities. • There will be available labour for fertiliser appplication • Environmental conditions will be favourable for crop growth during upscaling activities for fertilizer application in rice. • Policy environment will be enabling for upscaling of the TIMP • The market will be willing and able to absorb the extra produce arising from the increased yields.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The total cost of inorganic fertilizers is Kshs 15,000; Ksh 5,500, Kshs 3,500 and Kshs 6,000, per acre for P, K and N sources, respectively.
Estimated returns	One acre of rice has a marginal return of 10 bags @ Kshs 7,000, giving a total of Kshs 70,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Ownership of or access to land, farm inputs and credit is an important gender issue in the adoption of fertilizer use practice • Differing accessibility of the technology between men and women because of gender norms that place access to new information and technologies in the hands of male heads of households is a gender concern in adoption
Gender related opportunities	• Increased rice production and productivity will increase access to income and food among women, male and youth.

VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited access to information due to factors like physical disability affects technology access • Failure to attend awareness and sensitization campaigns due to physical body challenges or insecurity challenges. • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs
VMG related opportunities	• Application of fertilizers can improve rice productivity and production thus, more food and income for the VGMs.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Fertilizer application in Mwea has shown yield increase of between 5-8 bags per acre and more than 80% of the farmers use fertilizers in their paddies
Application guidelines for users	1. National Rice Development Strategy 2(2019-2030). Ministry of Agriculture, Livestock fisheries and Cooperatives.sww.kilimo.go.ke/wp-content/uploads/2021/01/ 2. W. A. Oyange, G.N. Chemining'wa, J.I. Kanya and P.N.Njiruh (2019). *Azolla* Fern in Mwea Irrigation Scheme and Its Potential Nitrogen contribution in Paddy Rice Production. *Journal of Agricultural Science*; 11, (18) pp-9752-9760 3. Wanjogu, R.K.; Mugambi, G.; Adoli H.L.; Shisanya, S.O. and Tamura, M. (1992). Mwea Rice Production manual, p22-23
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 - Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO Mtwapa, Box 16-80109, Phone- 0202024751, email-kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO;Oyange W.A.
Partner organizations	Capacity Development Project for Enhancement of Rice Production I Irrigation Schemes (CaDPERP), National Irrigation Authority, County Goverrments of Kirinyaga, County Goverment of Ksumu, Mwea Rice Growers Multi Purpose Society(MRGM)

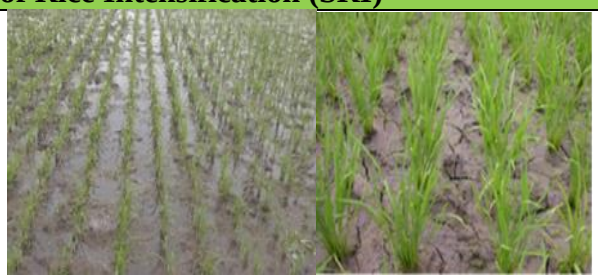
2.5.7 Timely harvesting

2.5.7 TIMPs name	Timely harvesting
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low quality of rice grain and loss of yield arising from early or late harvesting
What is it? (TIMP description)	This is the removal of the grain bearing plants or grain from the filed at the appropriate time. It involves all the process of collecting mature rice crop from the field. This is determined by the maturity indices of the rice variety. Early maturing varieties are harvested at 95 days while Medium maturing varieties can be harvested at 120-150 days after sowing. Late maturing varieties can reach 250 days. As a general rule, the harvest may begin only when 80-85% of the grains are ripened or have a golden yellow colour.
Justification	Early or late harvest can result in low quality of rice grain and loss of yield Timely harvesting ensures high quality rice grain and prevents harvest losses arising from exposure of the grain to vulnerable conditions such as pests and rodents.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Research scientists, extension agents, cooperatives, MoALD, grain stockists and merchants
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Training - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer-to-farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of technical capacity to determine maturity indices of different rice varieties • Availability of varieties suitable for specific Agro-ecological zones

Partners/stakeholders for scaling up and their roles	• County government extension services- Provide link with farmers. • National Irrigation Authority(NIA)-Provide technical support • Kenya Plant Inspectorate Services (KEPHIS)- ensure availability of only certified seed • Farmer groups and cooperatives - mobilisation of farmer
C: Current situation and future scaling up	
Counties where already promoted, if any	Kirinyaga, Kisumu, Busia, Siaya
Counties where TIMP will be upscaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia and West Pokot
Challenges in dissemination	• Inadequate extension agents familiar with local dialects of target areas • Availability of extension agents to train farmers during the rice cropping calendar • Availability of labour required for use in implementation
Recommendations for addressing the challenges	• Engage and capacity-build extension agents familiar with local dialects of target areas • Capacity build farmers to enable farmer-to-farmer sensitization.
Lessons learned in upscaling, if any	• Healthy and safety precautions in harvesting requires to be adhered to • Depending on the growth duration of the variety, harvesting time should be around 110−120 DAS for direct seeded rice, and 100−110 DAT for transplanted rice
Social, environmental, policy and market conditions necessary for development and upscaling	• Harvesting is socially acceptable in the target communities. • Environmental conditions will be favourable for proper and timely crop maturity during upscaling activities for harvesting of rice. • Policy environment is enabling for upscaling of the management practice • The market demand is able to absorb the extra produce arising from the increased yields.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development ,dissemination, adoption and scaling up	• Women perform most of the harvesting activities so the management practice may increase their work burden. • Women have less access to agricultural information, technology and knowledge. • Women have limited access to education, training and extension services.

Gender related opportunities	• Employment opportunities exist for women to perform the task of harvesting
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • VMGs have limited access to education, training and extension services.
VMG related opportunities	• Employment opportunities exist for women in performing the task of harvesting.
E: Case studies/profiles of success stories	
Success stories if any	None
Application guidelines for users	Kega et al. 2015 Rice production manual
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research**)**	Ready for upscaling
G: Contacts	
Contacts	1. Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 2. Institute Director KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa Phone: 020 2024751 Email: kalro.mtwapa@kalro.org 3. KALRO Call Centre 254 0111010100
Lead organization and scientists	KALRO; Oyange W.A.
Partner organizations	Agriculture Food Authority(AFA),MoALD,KEPHIS,

2.5.8 System of Rice Intensification (SRI)

2.5.8 TIMP Name SRI	**System of Rice Intensification (SRI)**
	 *Rice paddy lin the field*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	

Problem to be addressed	Low rice yields and high cost of production Low rice yields
What is it? (TIMP description)	System of Rice Intensification (SRI) is a rice farming methodology that aims to increase the yield of rice while using fewer resources and reducing environmental impacts through, establishment of 8-12 day old seedlings, 1 seedling per hill at wider spacing, using push weeders, and intermittent irrigation (AWD)
Justification	Low yields and high costs of production are exacerbated by the negative impacting of climate change on agricultural production. Furthermore, continuous cropping is depleting the already scarce resources Irrigation water continue to dwindle, farmers are experiencing low yields, high cost of farm inputs, declining soil fertility and generally low farm returns. SRI can save irrigation water by 25-50% compared to conventional flooding, save input cost by up to 50%, reduce the amount of GHGs emitted by rice farming, improve and restore soil health and increases yield by more than 30%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Paddy rice farmers in Public and community rice growing schemes
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social med
Critical/essential factors for successful promotion	• Stakeholders mobilization and sensitization • Availability of technical packages describing SRI technology • Building the capacity of local artisans to fabricate support tools • Awareness creation on the benefits and contribution of the SRI to paddy rice farmers.
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization and policy formulation • NIA- Provision of primary irrigation infrastructure • IWUA- Farmer mobilization and sensitization • Farmers groups – mobilisation of farmers and scale up the technology • Local artisans- fabrication of support tools • Development partners – to provide support on capacity building
C: Current situation and future scaling up	

Counties where already promoted if any	Kirinyaga, Kisumu, Busia
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta
Challenges in dissemination	• Lack of rice innovation platforms and fora for stakeholder engagements • Cultural, language and gender barriers • Poorly packaged dissemination pathways • Low technical capacity for farmers and extension providers
Suggestions for addressing the challenges	• Formation of rice innovation platforms for farmers, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Community or target audience mobilization and clarification of any issues. • Anticipate likely barriers to dissemination and address them • Develop easy-to-understand information packages for farmers
Lessons learnt in upscaling if any	The technology has potential to increase paddy yields. However, adoption of some components (1 seedling/hill, wide spacing, push remain a challenge. Farmers also continue to embrace use of herbicides instead of push weeders for weed control
Social, environmental, policy and market conditions necessary for development and upscaling	• Social issues- there has to be capacity building of farmers to shift their perception from random to line transplanting, using wider spacings • The technology is applicable to flooded rice production but not rainfed • Market issues- there is need to promote local artisanship products to fabricate push weeders • There is enabling policy environment for for uptake omf the management practice
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main cost is labour for land levelling and transplanting, estimated at KES 3,000/ and Kshs 7,000/acre, respectively
Estimated returns	One acre of paddy can provide an extra 6 bags @KES 7,000, total KES 42,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Ownership of or access to land, farm inputs and credit is an important gender issue in the adoption of SRI technology • Differing accessibility of the technology between men and women because of gender norms that place access to new information and technologies in the hands of male heads of households is a gender concern in adoption • Making decisions on land use, what to grow, expenditures and savings is an important gender consideration in SRI. This places a disadvantage to women and the youth

Gender related opportunities	• Increased rice production and productivity will increase access to income and food among women, male and youth. • Promoting mechanization will attract the youth to rice farming, reduce drudgery and balance productive and reproductive time for women gender in rice farming
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited access to information due to factors like physical disability affects technology access • Failure to attend awareness and sensitization campaigns due to physical body challenges or insecurity challenges. • The technology is labour intensive and may be difficult for the VMG to implement in the field. • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs • Competing priorities and household decisions might hinder adoption and scaling up.
VMG related opportunities	Application of SRI is expected to improve agriculture production thus, more food and income for the VGMs.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• A farmer in Mwea confirmed that SRI increases paddy yield and the grains are heavier than in conventional production method
Application guidelines for users	1. Mati BM, System of rice intensification, growing more with less water. Promoting the Adoption of SRI in Kenya, Brief Notes. http://sri.ciifad.cornell.edu/countries/kenya/KenyaBancyGDLNVC091109.pdf 2. Styger E, Uphoff N.(2016). The System of Rice Intensification (SRI): Revisiting Agronomy for a Changing Climate. Climate-Smart Agriculture Practice Brief. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 =Ready for upscaling
G. Contacts	
Contacts	1. Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 2. Institute Director KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa Phone: 020 2024751 Email: kalro.mtwapa@kalro.org 3. KALRO Call Centre 254 0111010100

Lead organization and scientists	KALRO;Oyange W.A.
Partner organizations	Capacity Development Project for Enhancement of Rice Production in Irrigation Schemes (CaDPERP), National Irrigation Authority, County Goverments of Kirinyaga, County Goverment of Kisumu, Mwea Rice Growers Multi Purpose Society (MRGM)

2.5.9 Water saving Rice Culture

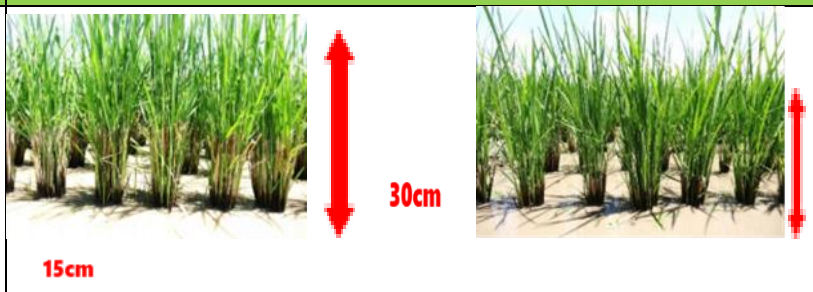
2.5.9 TIMP Name	**Water Saving Rice Culture**
	 *Rice paddy under irrigation*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	High costs of rice production, Low and declining rice yields in traditional rice production areas
What is it? (TIMP description)	Water Saving Rice Culture is a rice farming methodology is a modified SRI technology, that is customized for Mwea Irrigation Scheme farmers and aims to increase the yield of rice while using fewer resources and reducing environmental impacts through, the establishment of 21 day old seedlings, 2-3 seedlings per hill at a spacing of 30x15 cm, using manual levellers, push weeders, and intermittent irrigation (AWD) system and improved nutrition
Justification	Climate change is negatively impacting agricultural production. Irrigation water continues to dwindle, farmers are experiencing low yields, high cost of farm inputs, declining soil fertility and generally low farm returns. SRI can save irrigation water by 25-50% compared to conventional flooding. It can also save input cost by up to 50%, reduce the amount of greenhouse emitted by rice farming, improves and restores soil health and increase yield by more than 30%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice farmers, Researchers, Extension service providers, Agro-dealers, Agripreneurs

Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Stakeholders mobilization and sensitization • Availability of technical packages describing SRI technology • Building the capacity of local artisans to fabricate support tools • Awareness creation of the benefits and contribution of the SRI to paddy rice farmers
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization and policy formulation • NIA- Provision of primary irrigation infrastructure • IWUA- Farmer mobilization and sensitization • Farmers- scale up the technology • Local artisans- fabrication of support tools • Development partners – to provide support on capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga and Kisumu
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River and Taita Taveta
Challenges in dissemination	The main challenges in the dissemination and adoption have been; • The technology is labour-intensive in land levelling and line transplanting • Inadequate and timely water supply for the use of push weeders
Suggestions for addressing the challenges	• Promote and Support farmers with laser levelers • Support and Promote mechanized rice transplanting • Support farmers with mechanized weeders • Ensure adequate and timely supplemental irrigation water
Lessons learned in upscaling if any	The technology has potential to increase paddy yields. However, adoption of some components (1 seedling/hill, wide spacing, push remain a challenge. Farmers also continue to embrace use of herbicides instead of push weeders, for weed control.

Social, environmental, policy and market conditions necessary for development and upscaling	• Social issues: There has to be capacity building of farmers to shift their perception from random to line transplanting, using wider spacings • Market issues: there is need to promote local artisanship products to fabricate push weeders • There are no environmental or policy concerns as at now
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main cost is labour for land levelling and transplanting, estimated at KES 3,000 and KES 7,000/acre, repectively
Estimated returns	One acre of paddy can provide a total of 30 bags of Basmati 370 and 40 bags of other high yielding rice varieties (@ 90 kg)
Gender issues and concerns in development, dissemination, adoption and scaling up	• Ownership of or access to land, farm inputs and credit is an important gender issue in the adoption of WSRC technology • Differing accessibility of the technology between men and women because of gender norms that place access to new information and technologies in the hands of male heads of households is a gender concern in adoption • Making decisions on land use, what to grow, expenditures and savings is an important gender consideration in WSRC. This places a disadvantage to women and the youth
Gender related opportunities	• Increased rice production and productivity will increase access to income and food among women, male and youth. • Promoting mechanization will attract the youth to rice farming, reduce drudgery and balace productive and reproductive time for women gender in rice farming
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited access to information due to factors like physical disability affects technology access • Failure to attend awareness and sensitization campaigns due to physical body challenges or insecurity challenges. • The technology is labour intensive and may be difficult for the VMG to implement in the field. • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs • Competing priorities and household decisions might hinder adoption and scaling up.
VMG related opportunities	Application of WSRC is expected to improve agriculture production thus, more food and income for the VGMs.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Farmers in Mwea have confirmed that using WSRC increases rice productivity and that rice grains produced are heavier than in conventianal system • At least 30% of farmers in Mwea have adopted WSRC with 30% yield increase (Ricemapp endline survey, 2017)

Application guidelines for users	• www. academia.edu/es/41164030/Report_WSR rice production guideline (2016), V2 (unpublished)
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	Ready for upscaling
G. Contacts	
Contacts	Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 Institute Director KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa Phone: 020 2024751 Email: kalro.mtwapa@kalro.org KALRO Call Centre 254 0111010100
Lead organization and scientists	KALRO;Oyange W.A.
Partner organizations	Capacity Development Project for Enhancement of Rice Production in Irrigation Schemes (CaDPERP), National Irrigation Authority, County Goverrments of Kirinyaga, County Government of Kisumu, Mwea Rice Growers Multi Purpose Society (MRGM)

2.5.10 Improved ratoon Production (IRaP)

2.5.10 TIMP Name	**Improved ratoon Production (IRaP)**
	
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low ratoon crop yields arising from poor agronomic practices

What is it? (TIMP description)	IRaP farming technology involves appropriate nutrition of the main crop, followed by cutting back straw and nutrition management. After the main crop harvest, the stump is cut back to 15cm height followed by flooding with Irrigation water and application of K and N fertilizers within 14 and 21 days. Other agronomic practices are as per the main crop.
Justification	Nearly 70% of paddy rice farmers in Mwea Practice Rice-Ratooon cropping system, obtain below 30% yield returns, despite a potential of 75% of the main crop yield. This is mainly due to poor agronomic practices. Low cutting height and continuous flooding promotes stump rotting and fungal infection of crop stumps. Tillering is subsequently poor, with commensurate low yields of less than 50% of the potential. IRaP reduces stump rotting and increases ratoon yields by up to 50% (from 10 to 16 bags/acre) compared to conventional methods
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Paddy rice farmers in flooded rice production systems, Research scientists, Extension agents.
Approaches to be used in dissemination	• Farmer Field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer-to-farmer extension models • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, • social media short message services
Critical/essential factors for successful promotion	• Stakeholders mobilization and sensitization • Availability of technical packages describing SRI technology • Building the capacity of local artisans to fabricate support tools • Awareness creation on the benefits and contribution of the SRI to paddy rice farmers
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization and policy formulation • NIA- Provision of primary irrigation infrastructure • IWUA- Farmer mobilization and sensitization • Farmers- scale up the technology • Local artisans- fabrication of support tools • Development partners – to provide support on capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Kirinyaga, Kisumu, Busia, Siaya, Homabay, Migori, Tana River

Challenges in dissemination	• Inadequate extension staff to disseminate information • Inadequate irrigation water for ratoon cropping • Preference for other market demanded non-ratooning varieties
Suggestions for addressing the challenges	• Collaboration with Farmer organization- IWUA and Farmer producer organization of MRGM to help promote IRaP technology in Mwea • Promote use of e-extension • Promote water harvesting structures to provide supplemental irrigation water for ratoon cropping • Promote other high yielding ratooning varieties like Komboka
Lessons Learnt in upscaling if any	• Inadequate irrigation water has been a challenge to ratoon cropping in Mwea Irrigation Scheme. • In other Western Kenya irrigation schemes, there is preference for other market demanded non ratooning varieties like IR 2793
Social, environmental, policy and market conditions necessary for development and upscaling	• IRaP practices will be socially acceptable (particularly to the women and youth who form the labour force in rice production) in the target communities. • There will be available labour for implementing the IRaP • Environmental conditions will be favourable for crop growth during upscaling activities for IRaP. • Policy environment will be enabling for upscaling of the TIMP • The market will be willing and able to absorb the extra produce arising from the increased yields.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main cost is labour for cutting back the stumps and acquisition of fertilizers, estimated at KES 2,000 and KES 8500 per acre, respectively
Estimated returns	One acre of paddy can produce up to 21 bags of Basmati 370 (each 90kg), up from 10 bags per acre of conventional method.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Differing accessibility of the technology between men and women because of gender norms that place access to new information and technologies in the hands of male heads of households is a gender concern in adoption
Gender related opportunities	• Increased rice production and productivity will increase access to income and food among women, male and youth.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited access to information due to factors like physical disability affects technology access • Failure to attend awareness and sensitization campaigns due to physical body challenges or insecurity challenges. • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMG
VMG related opportunities	• Application of IRaP can improve rice productivity and production thus, more food and income for the VGMs.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Application of IRaP in Mwea Irrigation Scheme has increased Production from 10 bags to 21 bags/acre where

	scheduled and organized Improved ratoon production is practiced.
Application guidelines for users	1. Ricemapp (2016). Improved ratoon Production guidelines (unpublished) 2. RiceMAPP FLASH (2016) Vol.4-www.jica.go.jp/Resource/project/kenya/011/newsletter/ku57pq00002825kl-att/201602_4-4.pdf
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 =Ready for upscaling
G. Contacts	
Contacts	1. Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 2. Institute Director KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa Phone: 020 2024751 Email: kalro.mtwapa@kalro.org 3. KALRO Call Centre 254 0111010100
Lead organization and scientists	KALRO; Oyange W.A.
Partner organizations	Capacity Development Project for Enhancement of Rice Production in Irrigation Schemes (CaDPERP), National Irrigation Authority, County Governments of Kirinyaga, County Government of Kisumu, Mwea Rice Growers Multi-Purpose Society(MRGM)

2.6 OIL FERTILITY MANAGEMENT

2.6.1 Integrated Soil Fertility Management

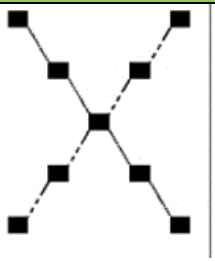
2.6.1 TIMP Name	**Integrated Soil Fertility Management**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Declining soil fertility, low organic matter, destroyed soil structure and limited moisture for crop production.
What is it? (TIMP description)	It is a set of soil fertility management practices that include the use of fertilizers, locally available organic inputs and improved seed, combined with the knowledge on how to adapt these practices to local conditions. This is aims at maximizing agronomic use efficiency of the applied nutrients and improving crop productivity. The ISFM emphasis the importance of using scarce resources like fertilizer and organic inputs efficiently by fertilizer banding, (direct application of fertilizer in the root-zone to increase the uptake) and

	micro dosing (applying small quantities of fertilizer with seed at planting time and a few weeks after emergence
Justification	Low yield and high fertilizer cost in rice farming are attributed to poor soils within the rice farming system. This is because of heterogeneous due to spatial variability in soil fertility. These inherent differences arise from the parent material from which the soil has evolved, and the position in the landscape that influences how soil develops. These challenges need to be solved by integrated soil fertility management (ISFM) approach that combines appropriate interventions including fertilizer use and crop agronomy. The main aim of ISFM is therefore to optimize agronomic use efficiency of the applied nutrients for improved crop productivity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved ISFM technologies • A platform for interaction for rice value chain stakeholders • Well organized farmer groups and networks for easier training and adoption of ISFM management practices • Sensitization and training farmers on the benefits of ISFM • Adequate resources to develop publicity materials • Collaboration among rice value chain actors and partnersconsisting of Researchers, Extension agents, Lead farmers, Service providers and County Governments) for success promotion of ISFM • Participatory on-farm demonstrations by stakeholders
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of ISFM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level

	• Community farmer groups- play coordination role for ease in problem identification and dissemination.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be promoted	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Perception that organic fertilizer does not provide suffient nutrient to increase rice yield • Inadequate and appropriate extension materials on ISFM to compliment training • Availability of extension agents to train farmers during rice cropping calendar • Perception that organic fertilizers are expensive may hinder adoption.
Suggestions for addressing the challenges	• Capacity building and awareness creation of organic and inorganic complementary effect • Collaboration between partners and count governments in the development of extension materials • Collaboration between partners and Count Governments in provision of extension services during rice cropping calender • Provision of Government support through subsidy of onorganic fertilizers
Lessons learned if any	For ISFM to succeed, good germplasm/seed/seedlings for optimum yield to be realized especially superior seeds.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in ISFM training to enhance adoption • Environmental: Highlight the research results showing the benefits of ISFM options to environmental safety, food safety and human health • Market conditions: Availability of ISFM products close to the farmers is essential for their uptake. • Capacity build farmers on benefits of ISFM to create market demand • Policy: Provide enabling policy guiding and supporting the use of ISFM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	This is a technically demanding technology and high cost are involved to purchase clean seed, mineral fertilizer, pest control, manure application.
Estimated returns	Farmers who have adopted ISFM technologies have more than doubled their agricultural productivity and increased their farm-level incomes by 20 to 50 percent.
Gender issues and concerns in development and dissemination	• It is labour intensive hence may not be adopted by women who are already overburdened • Women and youth have limited access to credit to purchase the required inputs such as such as fertilizers

	• Women and youth have limited access to land for rice cultivation • Women have less access to agricultural information, technology and knowledge.
Gender related opportunities	• Opportunity exist for women to access the required credit through the women enterprise funds.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for rice cultivation • VMGs have less access to agricultural information, technology and knowledge • It is labour intensive hence may not be adopted by some VMGs who are elderly • VMGs have limited access to credit to purchase the required inputs such as such as fertilizers .
VMG related opportunities	• Affirmative action in various areas as for instance in the provision of finances to VMGs • Increased production due to use of the TIMP will lead to increased consumption and utilization of rice and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	N/A
Application guidelines for users	Esilaba, A.O.et al. (2021). KCEP-CRAL Climate Smart Agiculture Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya. https://www.kalro.org/research-projects/kenya-cereal-enhancement-programme-climate-resilient-agricultural-livelihood-window-kcep-cral/kenya-cereal-enhancement-programme-kcep-cral-manuals/ Esilaba, A.O. et al. (2021). KCEP-CRAL Integrated Soil Fertility and Water Management Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya
F: Status of TIMP readiness (1=Ready for upscaling: 2=Requires validation; 3=Requires further research	2 =Requires validation
G: Contacts	
Contacts	Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org Istitute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Kundu C. Oyange W.A.
Partner organizations	ASERECA, ICRAF

2.6.2 Soil testing

2.6.2 TIMP Name	Soil testing
	  
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to lack of information on essential nutrient availabile in the soils
What is it? (TIMP description)	This a procedure of collecting soil samples and analyzing them for various parameters; pH, nutrient status and other soil properties. Using a soil augur or spade, samples are drawn from 15-20cm top soil level, in a zig zag manner, composted and tested for the respective nutrients, at recommended soil testing laboratories.
Justification	Soil testing determines soil fertility status and the optimum fertilizer and amendments required. It identifies nutrient deficiencies and potential toxicities thus preventing crop damage and improve plant growth. It also determines the pH level, which can affect the availability of nutrients to plants and helps in identifying the presence of heavy contaminants, which can affect plant growth.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Traders, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Availability of soil testing laboratories and affordability of costs. • Awareness creation on the benefits of the practice and recommendations for paddy and upland rice production.

	• Technical packages describing the importance of soil testing to rice farmers
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization • NIA, KALRO, Universities- Provision of soil testing services • IWUA- Farmer mobilization and sensitization • Farmers- request for soil testing services and use of results • Agro-input dealers- Site specific input supply • Development partners – to provide support on capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Accessibility and affordability of soil testing services • Lack of awareness of the importance of soil testing • Inadequate extension staff
Suggestions for addressing the challenges	• Provision of mobile soil testing laboratories in rice production areas • Subsidide soil testing services to enable affordability and acces • Support mass testing and development of soil suitability maps • Promote use e-extension to create awareness
Lessons Learnt in upscaling if any	• There has been mushrroming of unaccredited soil testing facilities providing unreliable recomendations
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in siol testing training to enhance adoption • Environmental: Highlight the research results showing the benefits of soil testing to environmental safety, food safety and human health • Market conditions: Availability of soil testing facilities close to the farmers is essential for their uptake. • Capacity build farmers on benefits of soil testing to create market demand • Policy: Provide enabling policy guiding and supporting the use of soil testing and review policy from time to time. There should be policy guidelines on accreditation and licensing of soil testing service providers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Testing of three composite samples per acre costs KES 4500
Estimated returns	Marginal increase in yields amounts to 5-8 bags per acre @ KES 7,000 totalling Ksh 45,000

Gender issues and concerns in development, dissemination, adoption and scaling up	• Differing accessibility of the management practice between men and women because of gender norms that place access to new information and technologies in the hands of male heads of households is a gender concern in adoption • Ownership of or access to land, farm inputs and credit is an important gender issue in the adoption of soil testing practice
Gender related opportunities	• Increased rice production and productivity will increase access to income and food among women, male and youth.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited access to information due to factors like physical disability affects technology access • Failure to attend awareness and sensitization campaigns due to physical body challenges or insecurity challenges. • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs
VMG related opportunities	Soil testing provides apporptiate nutrient recomendations and can improve productivity and production thus more food and income for the VMGs.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Mwea have reported increased yields, reduced incidences of rice crop lodging, reduced incidencs of blast disease in rice, due to soil testing and application of appropriate fertilizers, recomendations from Mwea Irrigation Agricultural Development Centre(MIAD.)
Application guidelines for users	Esilaba, A.O. et al. (2021). KCEP-CRAL Integrated Soil Fertility and Water Management Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya. https://www.kalro.org/research-projects/kenya-cereal-enhancement-programme-climate-resilient-agricultural-livelihood-window-kcep-cral/kenya-cereal-enhancement-programme-kcep-cral-manuals/
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	1 =Ready for upscaling
G. Contacts	
Contacts	Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Kundu C and Oyange W.A.
Partner organizations	Capacity Development Project for Enhancement of Rice Production I Irrigation Schemes (CaDPERP), National Irrigation Authority, County Goverrments of Kirinyaga, County Goverment of Ksumu, Mwea Rice Growers Multi Purpose Society(MRGM)

2.6.3 Vermicomposting

2.6.3 TIMP Name	Vermicomposting
Category (i.e. technology innovation, or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Soil degradation due to prolonged use of inorganic fertilizers and pesticides.
What is it? (TIMP description)	It is a decomposition process using various species of worms, usually red wigglers, white worms and other earthworms to create a mixture of decomposing vegetable or food waste, bedding materials, and vermicast. It contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner for rice production.
Justification	Increased cost of inorganic fertilizers coupled with excessive application leads to higher costs of production and emission of GHGs that degrades the environment. Vermicopsting is an innovative way to increase production while reducing the costs involved in production. Further it leads to saving on chemical inputs while leveraging on environmental sustability.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Traders, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Availability of the initial start-up culture for vemicomposting • Lack of technical capacity to produce the fertilizer in bulk with the right nutrients substrates in vermicompost technology products. • Promotion of vermicompost use as a complementary of other conventional inputs rather than a stand alone technology.
Partners/stakeholders for scaling up	• CABI-Provision of technical capacity in entomology • Fertilizer agro-dealers to stock fertilizer products from vermicompost process • KALRO-testing of nutrient composition of the fertilizer produced • County Government: Extension offers to mobilize and Capacity build farmers

	• Framers –To start commercial production of vermicompost fertilizers
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be promoted	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited resources to prepare dissemination/ communication materials • Lack of effective rice innovation platforms and fora for stakeholders engagements • Lack of technical capacity to produce the fertilizer in bulk with the right nutrients substrates in vermicompost technology products. • Use of jargon or poorly packed information not ready for use by farmers and partners • Perception that vermicomposting is a complex venture • Lack of standard/specialized packaging materials of vermicompost products thus transportation might be a challenge
Recommendations for addressing the challenges	• Involve partners and County Governments in dissemination, developing publicity and extension materials • Creation of rice innovation platforms or fora for farmers, researchers, advisors, national & county governments, seed merchants, processors, NGOs, seed merchants and input suppliers for common and agreed approaches • Building technical capacity while implementing the technology • Develop easy to understand information packages for farmers. • Provision of the initial start-up culture of vermicomposting insects by the relevant stakeholders to the farmers • Innovate specialized packaging materials for vermicompost materials.
Lessons learned	• Low level of adoption due to competitive inorganic products which are perceived rapid nutrient releasing products.
Social, environmental, policy and market conditions necessary	• Environment- The vermicompost reduces environmental degradation. • Policty- Legislation should be formulated to enhance use of organic products such as vermicompost fertilizers along with minimum inorganic fertilizer .
D:Economic,gender,vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic cost for acquiring initial start up insect culture – KES 2500
Estimated returns	Estimated returns of rice yield per acre 6-8 bags @KES 7000= KES 42000
Gender issues and concerns in development and dissemination	• Women and youth have less access to credit to purchase the required initial input to start vermicompost culture • Women have less access to agricultural information,

	technology and knowledge • Women have limited access to education, training and extension services that is required to start vernicompost and maintain.
Gender related opportunities	Employment opportunities exist for youths in performing the task.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to credit to purchase the required inputs to purchase initial culture • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • VMGs have limited access to education, training and extension services.
VMG related opportunities	Increased rice production will enhance availability of food at an affordable prices for VMGs to acquire.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Infonet-biovision. Vermicomposting: Earthworms in Action. https://infonet-biovision.org/res/res/files/4096.Vermicompost%20kenya.pdf
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further researc**h**	Ready for upscaling
Contacts	Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Kundu C., Oyange W.A.
Partner organizations	CABI, ICIPE, KALRO

2.6.4 Urea Deep Placement

2.6.4 TIMP Name	Urea Deep Placement
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to low nitrogen uptake.
What is it? (TIMP description)	It is a climate smart technology of Nitrogen fertilizer application, involving drilling of Urea granules (1-3 grams) 7-10 cm below the ground, through a manual or mechanical process. Conventiaol broadcasting of urea is a wastefull method, with a potential loss of 60-70% of the nutrient N, contributing significantly to green house gas emission (knowledge cente TAAT-africa.org). The cost of inorganic Nitrogen fertilizer are high and on the increase.
Justification	Urea Deep Placement is a climate-smart solution for rice systems. With the high cost of inorganic nitrogen fertilizers and potential loss of 60-70% of the nutrient N, UDP technology is a more efficient method of N application, with slow N release. The N application is also done once compared to the split conventional method of application.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Traders, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Availability of UDP applicators and Urea briquetter making equipment in Agro-input dealer stores • Presence of technical packages describing the application of UDP technology • Stakeholders' mobilization and sensitization • Awareness creation on the benefits of the practice for rice production.
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization • Agro-input dealers to stock UDP technology • Local artisans to fabricate UDP appplicators • IWUA- Farmer sensitization and awareness creation • MRGM- Farmer education

	• Development partners – to provide support on sensitization and capacity building • Research Institutions- Customization of application technology to less labout intensive methods.
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Busia
Counties where TIMP will be Up-scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Lack of specialized equipment to produce the urea briquettes may hinder dissemination of the Technology • Unavailability of UDP stocks in agro-dealer outlets may be a hinderance to dissemination • High labour demand for UDP method • Limited technical knowledge and skills requirement to implement.
Suggestions for addressing the challenges	• Support acquisition and availability of Urea briquette making equipment • Sensitization of agro-dealers to stock urea briquettes by extension staff • Research on less labour intensive application innovations • Capacity building and establishment of demonstation sites
Lessons Learnt in upscaling if any	• There has been poor adoption of the technology due to lack of awareness, labour intensive nature and lack of briquettes/briquette making machines
Social, environmental, policy and market conditions necessary for development and upscaling	• The technology is a climate-smart solution for rice systems and therefore does not harm the environment • The technology enhances production, therefore improving livelihoods • Increased rice production, will lead to satisfaction of market demands
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Additional KES 2,000 per acre is required for UDP application
Estimated returns	Marginal increase in yields amounts to 5 bags per acre @ KES 7,000 totalling KES 35,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Intensive labour requirement limits accessibility of the technology to the disadvantage of women gender • Differing accessibility of the technology between men and women because of gender norms that place access to new information and technologies in the hands of male heads of households is a gender concern in adoption.
Gender related opportunities	• Increased rice production and productivity will increase access to income and food among women, male and youth • UDP technology can create employment for the youth as service providers.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited access to information due to factors like physical disability affects technology access • Failure to attend awareness and sensitization campaigns due to physical body challenges or insecurity challenges.

	• The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs.
VMG related opportunities	• UDP can improve productivity and production, thus availability at reduced cost for the VGMs.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• N/A
Application guidelines for users	CTCN. Urea Deep Placement (UDP) Technique. https://www.ctc-n.org/products/urea-deep-placement-udp-technique
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 =Ready for upscaling
G. Contacts	
Contacts	Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Oyange W.A.
Partner organizations	Capacity Development Project for Enhancement of Rice Production in Irrigation Schemes (CaDPERP), National Irrigation Authority, County Goverrments of Kirinyaga, County Goverment of Ksumu, Mwea Rice Growers Multi Purpose Society (MRGM)

2.6.5 Sequential cropping

TIMP Name	**Sequential cropping**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low rice production due to loss of soil fertility.
What is it? (TIMP description)	Sequential cropping is the growing of other crops in a rice/paddy field, preceeding or succeeding a rice crop. Most rice paddy cropping systems in Kenya are Rice-Rice-Legumes, Rice-Maize , Rice-Horticulture and Rice-fallow. Continuous monoculture of rice cropping results in poor soil nutritional conditions, loss of soil fertility and unsustainable rice production.
Justification	Low soil productivity resulting from rice monoculture is detrimental to sustainable rice production. Producion systems which improve soil health are therefore important. Sequential

	cropping enhances soil health and promotes efficient nutrient utilization for sustainable rice crop production.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, Cooperatives, NIA, Traders, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Technical packages describing the application of crop sequential cropping system • Stakeholders' mobilization and sensitization • Awareness creation on the benefits of crop sequential system for rice production.
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization • NIA- Developmet of cropping calendar and Farmers sensitization • IWUA- Farmer mobilization and sensitization • Farmers- scale up the technology • Off-takers- purchase of sequential crop produce • Development partners – facilitate capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders. • Lack of stakeholder forums to sensitizing farmers on Sequential cropping • Inadequate resources and extension agents to train farmers • Limited information materials on Sequential cropping • Lack of awareness on the importace of sequential cropping • Farmers preference of paddy rice farming due more returns • High level of sub-letting of paddy fields to outsiders, who prefer rice farming.
Suggestions for addressing the challenges	• Eastablish rice innovation platforms to enhance stakeholder interaction • Establish stakeholder forums to sensituize farmers on Sequential cropping • Involve County Extension agents in Sensitization and training

	• Involve all partners in developing extension materials • Capacity building of farmers on benefits of rice-sequential cropping on sustainable rice production • Synchronized sequential cropping and provision of assured market for sequential produce.
Lessons Learnt in upscaling if any	• Sequential cropping has been more acceptable in irrigation schemes where farmers practice rice-fallow cropping systems
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in training to enhance adoption • Environmental: Highlight the research results showing the benefits of crop sequessing to environmental safety, food safety and human health • Market conditions: Availability of soil testing facilities close to the farmers is essential for their uptake. • Capacity build farmers on benefits of crop sequential activities to create market demand • Policy: Provide enabling policy guiding and supporting the use of ISFM and review policy from time to time. There should be policy guidelines on accreditation and licensing of soil testing service provider.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The aveage cost per acre is KES 30,000 per acre, but varied depending the crop; KES 30,000 (legumes), KES 35,000 (Maize)
Estimated returns	One acre of sequential crop; Soya beans gives avarege 5 bags @ KES 10,000 / bag, total KES 50,000 per acre, Maize 18bgs @ KES 4000, total KES 52,000.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Ownership of or access to land, farm inputs and credit is an important gender issue in the adoption of sequential cropping • Making decisions on land use, what to grow, expenditures and savings is an important gender consideration in sequential cropping. This places a disadvantage to women and the youth
Gender related opportunities	• Sequential cropping increases alternative income and food among women, male and youth.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited access to information due to factors like physical disability affects technology access • Failure to attend awareness and sensitization campaigns due to physical body challenges or insecurity challenges. • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs.
VMG related opportunities	Timely and appropriate weed control can improve rice productivity and production thus, more food and income for the VMGs.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Three farmers in Mwea, who grew green grams as sequential crop, with Kilimo Trust support, reported better performance of the subsequent rice crop and reduced incidences of weed pests.

Application guidelines for users	RiceMAPP (2015). Guidelines to sequential cropping in Mwea Irrigation Scheme(unpublished).
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requiresfurther research**)**	1 =Ready for upscaling
G. Contacts	
Contacts	Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO, Mwea Irrigation Agricultural development Centre, Capacity Development Project for Enhancement of Rice Production in Irrigation Schemes (CaDPERP),
Partner organizations	Mwea Rice Growers Multipurpose Society, County Goverrments of Kirinyaga, County Goverment of Ksumu, Mwea Rice Growers Multi Purpose Society(MRGM)

2.6.6 Site specific Nutrient Management (SSNM)

2.6.6 TIMP Name	**Site specific Nutrient Management (SSNM)**
Category (i.e. technology innovation, or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low rice yields due to inefficient use of fertilizer.
What is it? (TIMP description)	Site specific nutrient management follows the 4 R (right source , right location, right time and right amount). SSNM seeks to improve agricultural productivity, efficiency, and profitability through the use of modern, innovative, cutting-edge, site-specific technologies that regulate the spatial and temporal variability of soil inherent nutrient supply. Judicious nutrient management is critical in the production of rice crop. SSNM Technologies employed in the assessement of N in rice production: • Optical crop canopy sensor (Green Seeker) reduces N application, improves recovery efficiency and increased agronomy over blanket application • Use of drones to generate prescription map for N application.

Justification	SSNM is a precision technology that can improve food production while lowering costs and leaving small environmental footprint. This is due to inherent variability of soils within the field. SSNM is a timely practice for farmers involved in rice production. SSNM can increase rice production by 11% and recovery of 30-40% on average for the input.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, CGIARs, NIA, Traders, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Stakeholders' mobilization and sensitization • Awareness creation on the benefits of the practice for rice production. • Technical capacity in developing local expertise is urgently required to enhance dissemination • Availability of information packages suitable for the farming community
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization • NIA - Developmet of cropping calendar and Farmers sensitization • IWUA- Farmer mobilization and sensitization • Farmers- scale up the technology • Development partners – facilitate capacity building
C: Current situation and future scaling up	
Counties where already promoted	Counties where irrigated and upland rice is grown.
Counties where TIMP will be promoted	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Heavy financial investment to train local expertise in dissemination of the technologies • Weak internet connectivity will hamper transmission of real-time data and advisory systems to the end users
Suggestions for addressing the challenges	• Stakeholders partnership in facilitating training forums and setting up of trials and demonstration sites for familiarization and building rural digital agriculture expertise

	• Creation of more broadband points to enhance connectivity to rural areas for real-time data and prescription purposes.
Lessons learned in scaling up	SSNM requires more vibrant awareness creation for the end users to have a paradigm shift from traditions and uniform fertilizer application in field variabilities.
Social, environmental, policy and market conditions necessary	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	
Estimated returns	
Gender issues and concerns in development and dissemination	• Women and youth have less access to credit to purchase required inputs • Women have less access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services.
Gender related opportunities	• Employment opportunities exist for youths in performing the task of advisory and mapping rice fields to generate prescription maps.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services.
VMG related opportunities	Employment opportunities exist for youths in performing the task of advisory platforms.
E: Case studies/profiles of success stories	
Success stories	No success stories at the moment
Application guidelines for users	• GASCA (2015) Site-Specific Nutrient Management:Implementation guidance for policymakers and investors. https://cgspace.cgiar.org/bitstream/handle/10568/69016/CCAFSpbNutrient.pdf • IIRI Site-specific nutrient management (SSNM) manual.http://www.knowledgebank.irri.org/ericeproduction/PDF_&_Docs/ssnm_manual.pdf IIRI (2007) Rice: A Practical Guide to Nutrient Management (2nd edition) http://books.irri.org/97898179494_content.pdf
F: Status of TIMP readiness	
(1=Ready for up-scaling: 2=Requires validation; 3=Requires further research	2 - Requires validation
G: Contacts	
Contacts	Centre Director: KALRO-ICRI-Mwea, P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217. Fax: +254 020-3589054. E-mail: kalro.mwea@kalro.org

	Center Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and Scientists	KALRO Oyange W.A.
Partner organizations	CABI, NIA, Elgon Ltd, Amiran Ltd, Astral Ltd.

2.7 WATER AND IRRIGATION MANAGEMENT

2.7.1 Continuous flooding

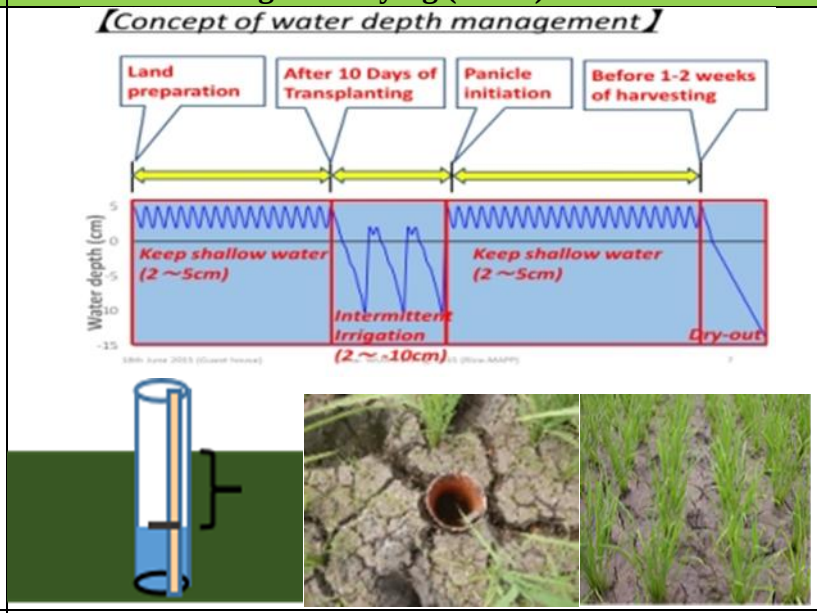
TIMP Name	**Continuous flooding**
	 Continous flooding of paddy field
Category (i.e. technology innovation, or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Lowland rice is extremely sensitive to water shortage (below saturation) at the flowering stage. Lack of water at flowering stage results in yield loss from spikelet sterility resulting into fewer grains thus low yield.
What is it? (TIMP description)	This is a method of flooding puddles when young seedlings are planted. Continuous flooding of water generally provides the best growth environment for rice. After transplanting, water levels should be around 3 cm initially, and gradually increase to 5−10 cm (with increasing plant height) and remain there until the field is drained 7−10 days before harvest. For direct seed, direct wet seeded rice, field should be flooded only once the plants are large enough to withstand shallow flooding (3 - 4 leaf stage).
Justification	Lowland rice is very sensitive to water deficit (sub-saturation) during flowering that can severely reduce rice yield potential. Continuous flooding requires a watering plan to suppress the

	growth of weeds and pests. In addition, it helps ensure adequate water supply during the development of the rice crop in the field. Continous flooding results to high paddy quality and yield.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Traders, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Availability of adequate water for irrigation in rice fields during demonstrations • Leveled land to enhance flooding • Avaialability of labour for creation of bunds, hard pan and repair any cracks or holes
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization • NIA- Provision of primary irrigation infrastructure • IWUA- Farmer mobilization and sensitization • Farmers- scale up the technology • Development partners – to provide support on capacity building
C: Current situation and future scaling up	
Counties where already promoted	Counties where irrigated and upland rice is grown.
Counties where TIMP will be promoted	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	Lack of adequate water due to water scarcity in lowland irrigated rice areas.
Suggestions for addressing the challenges	Increasing water collection and storage sources and rationing of the water supply.
Lessons learned in scaling up	It requires a lot of water for implementation.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in water management training to enhance adoption • Environmental: Highlight the research results showing the benefits of water management to environmental safety, food safety and human health • Market conditions: Availability of water management fservices close to the farmers is essential for their uptake.

	• Capacity build farmers on benefits of water management to create market demand • Policy: Provide enabling policy guiding and supporting the use of ISFM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic estimated costs will be about 4000
Estimated returns	Estimated returns for per 25 bags @7000=175,000
Gender issues and concerns in development and dissemination	• Women and youth have less access to credit to pay for the required labour • Women have less access to agricultural information, technology and knowledge. • Women have limited access to education, training and extension services.
Gender related opportunities	• Employment opportunities exist for youths in performing the task of flooding in the fields to generate prescription maps
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services.
VMG related opportunities	Employment opportunities exist for youths in performing the task of advisory platforms.
E: Case studies/profiles of success stories	
Success stories	No success stories at the moment
Application guidelines for users	• http://www.knowledgebank.irri.org/decision-tools/rice-doctor/rice-doctor-fact-sheets/item/flooding-or-submergence • The International Rice Research Institute (IRRI)(2013), TECA technologies and practices for small agricultural producers(2018). Rice farming: saving water through Alternate Wetting Drying
F: Status of TIMP readiness (1=Ready for up-scaling: 2=Requires validation; 3=Requires further research	Ready for upscaling
G: Contacts	
Contacts	Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 KALRO Call Center: 0111010100
Lead organization and Scientists	KALRO Mwea Irrigation Agricultural development Centre Capacity Development Project for Enhancement of Rice Production in Irrigation Schemes (CaDPERP).

Partner organizations	Mwea Rice Growers Multipurpose Society, County Goverrments of Kirinyaga, County Goverment of Ksumu, Mwea Rice Growers Multi Purpose Society(MRGM)

2.7.2 Alternate Wetting and Drying (AWD)

TIMP Name	Alternate Wetting and Drying (AWD)
	
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Scarcity of adequate water for irrigation resulting in reduced rice yield.
What is it? (TIMP description)	This is an alternative irrigation water management technique where the field is flooded 2 – 5 cm heigh then irrigation water is withheld till the sub-surface water is 10 -15 cm. It commences at 7-10 day after transplanting and is repeated till the rice crop is at panicle initiation stage.
Justification	Irrigation water for rice production continue to dwindle negatively affecting rice yield. Conventional rice production system employs continuous flooding method that is wasteful and significantly contributes to GHG emissions. Alternate wetting and drying technology saves 15-25% irrigation water, increases tillering by 25%, promotes good root anchorage, reduces plant lodging, increases crop yield, reduces methane gas emissions and reduces cost of rice production.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Cooperatives, Traders, Seed dealers and Agriprenuers.

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals.
Critical/essential factors for successful promotion	• Availability of Irrigation water • Availability of technical packages describing AWD technology • Awareness creation on the benefits and contribution of the AWD to paddy rice farmers. • Stakeholders mobilization and sensitization.
Partners/stakeholders for scaling up and their roles	• National and County governments – to provide extension services, farmer mobilization • NIA- Provision of primary irrigation infrastructure • IWUA- Farmer mobilization and sensitization • Farmers- scale up the technology • Development partners – to provide support on capacity building .
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Inadequate extension staff in rice growing areas • Inadequate knowledge by the extension staff • Inadequate and timely availability of irrigation water • Manual and unreliable methods of determining soil moistre levels.
Suggestions for addressing the challenges	• Promotion of e-extension services • Collaborating with IWUA and Farmer producer organization like MRGM to help in dissemination of the technology • Capacity building of extension staff and farmers water management technologies • Development and availability of technical packages • Research on the water management technology.
Lessons learnt in upscaling if any	Water shortage is a major challenge in adoption of the technology
Social, environmental, policy and market conditions	• Use of AWD reduces irrigation water equirement and reduces conflicts among rice farmers • AWD application reduces Green House Gas emission.

necessary for development and upscaling	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main cost is additional weeding resulting from withholding of irrigation water, estimated at Kshs 4,500 per acre
Estimated returns	The is estimated 20% yield increase, 4 bags@ Kshs 7,000, total Kshs 28,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Ownership of or access to land, farm inputs and credit is an important gender issue in the adoption of AWD technology • Differing accessibility of the technology between men and women because of gender norms that place access to new information and technologies in the hands of male heads of households is a gender concern in adoption • Making decisions on land use, how to grow, expenditures and savings is an important gender consideration in AWD. This places a disadvantage to women and the youth
Gender related opportunities	• Increased rice production and productivity will increase access to income and food among women, male and youth. • Promoting mechanization will attract the youth to rice farming, reduce drudgery and balace productive and reproductive time for women gender in rice farming.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited access to information due to factors like physical disability affects technology access • Failure to attend awareness and sensitization campaigns due to physical body challenges or insecurity challenges. • The technology is labour intensive and may be difficult for the VMG to implement in the field. • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs • Competing priorities and household decisions might hinder adoption and scaling up.
VMG related opportunities	Application of SRI in rice production improves agriculture production thus more food and income for the VGMs.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	• The International Rice Research Institute (IRRI)(2013), TECA technologies and practices for small agricultural producers(2018). Rice farming: saving water through Alternate Wetting Drying (AWD) method, Indonesia. *www. fao.org/3/ca4023en/ca4023en.pdf* • RiceMAPP, 2013. Guidelines for Water Saving Rice culture.

F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 =Ready for upscaling
G. Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Mwea Irrigation Agricultural development Centre Capacity Development Project for Enhancement of Rice Production in Irrigation Schemes (CaDPERP).
Partner organizations	Mwea Rice Growers Multipurpose Society, County Goverrments of Kirinyaga, County Goverment of Ksumu, Mwea Rice Growers Multi Purpose Society(MRGM).

2.8 PRECISION AGRICULTURE

2.8.1 Drone Technology for Remote Sensing in Surveillance of Pests and Diseases (DJI-MAVIC-3-MULTI-SPECTRAL)

2.8.1 TIMPs name	**Drone Technology for Remote Sensing in Surveillance of Pests and Disease (**DJI-MAVIC-3-MULTI-SPECTRAL)
	 **DJI-MAVIC-3-MULTISPECTRAL** **photo credit:AERMATICA**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Inefficient manual surveillance of pests and diseases in rice fields.

What is it? (TIMP description)	DJI-MAVIC-3-MULTI-SPECTRAL The drones used in pest and disease surveillance have an RGB camera with a 20-megapixel image sensor and a fast shutter. A multispectral camera is also included for improved crop analysis. These drones have 5000 mAh batteries and can fly up to 46 minutes making efficient in monitoring rice crops. Use of conventional pest and disease monitoring techniques require scouting which is time cosuming and tedius. The use of drone technology will reduce time taken and improve accuracy of predicting time for application of management practices.
Justification	Manual surveillance is slow and ineffective. Tropical rice harvests are seriously threatened by insect pests like the yellow stem borer (YSB) and diseases including rice blast, bacterial blight, and sheath blight. Precision technology develops intervention maps using vegetation indices from multispectral surveys. Drones provide reliable information in real time, allowing farmers and extension workers to make real time decisions.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Cooperatives, Traders, Seed dealers, Drone Licensed companies and Agriprenuers.
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Initial capital to acquire drones requires financial investment • Requirement of licensing and training authorization from KCAA • Availability of internet connection for transmission of real time data • Technical training of extension and farmers on interpretation of prescription map details • Capacity building of farmers and cooperative formation • Starter-up companies for hire/availing services to the rice farmers
Partners/stakeholders for scaling up and their roles	• County government extension services; Provide link with farmers.

	• National Irrigation Authority (NIA) • Kenya Civil aviation Authority (KCAA) • Licensed drones operator and distributors • Community Interest Groups (CIGs) • Farmer cooperatives
C: Current situation and future scaling up	
Counties where already promoted, if any	None
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Changing weather conditions such as rain might hamper surveillance due to invisibility • Lack of credit facilities in purchasing drones • Inadequate repairs and of software's availability in the country • Unavailability of 4 G / 5 G internet connectivity to transmit real time data from rural areas • Lack of adequate technical training materials.
Recommendations for addressing the challenges	• Build technical capacity in precision agriculture from research levels to extensions and farmer (end user). • Farmers to form groups and work together and aggregate resources to purchase drones for rice pest and disease surveillance • Provide credit facilities for smalholder farmers to purchase drones • Extension serveices and digital technology for information sharing • Government to continue distributing internet services in the rural areas where rice is grown for easy accessibility of network.
Lessons learned in upscaling, if any	• Real time forecast of data on pests and disease management and recommendation will reduce cost of inputs such as pesticides • Technical capacity of digital skills in rice management are required for realization of precision agriculture technology dissemination.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in drone trainings to enhance adoption • Environmental: Highlight the research results showing the benefits of the use of drones to environmental safety, food safety and human health • Market conditions: Availability of drones close to the farmers is essential for their uptake. • Capacity build farmers on benefits of drones to create market demand • Policy: Provide enabling policy guiding and supporting the use of drones and review policy from time to time. Adoption of drone technology has potential since the government

	through KCAA act of 2020 has legalized drone operation against different activities including in agriculture. • Adoption of drone technology has potential to reduce intensive labour used in manual rice field scouting.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic cost for DJI-MAVIC-3-MULTI-SPECTRAL, = $2398 equivalent to Kshs 335,720 @ exchange rate of Kshs 140.
Estimated returns	Returns on a minimum of 100 acre per season, 1 acre produces 6-8 bags @7000 per bag 17,500,000
Gender issues and concerns in dissemination, adoption and scaling	• Women and youth may also have limited access to finances to buy the drone technology. • Women have less access to drone technology compared with men • Women have limited access to education, training and extension services.
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Employment opportunity exist for youths in operating the drones
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have less access to drone information, technology and knowledge. • VMGs may also have limited access to finances to buy the technology. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination of the technology. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit. • Employment opportunity exist for youths in operating drones
E: Case studies/profiles of success stories	
Success stories from previous similar projects	N/A
Application guidelines for users	**Reference** • Generalmanager @ AERMATICA3D • Nayak, A. K. (2022). Advanced Techniques for Precision Farming in Rice. *Climate Resilient Technologies for Rice based Production Systems in Eastern India*. • Astral UAV service • CABI.org • DJI AGRICULTURE
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research**)**	Requires validation

G: Contacts	
Contacts	Center Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO - Tabu R.O
Partner organizations	NIA, KCAA, MOALD, Kenya Space Agency, Farmer cooperatives, Rice Millers

2.8.2 Drone Technology in pests and disease spraying of pesticides, (DJI Agras T40).

2.8.2 TIMPs name	Drone Technology in spraying of pesticides (DJI Agras T40)
Category (i.e. technology, innovation or management practice)	Technology  **AGRAS T40. Photo Credit.FlyingAG.COM**
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss in rice production due to pests and diseases inffections, aggravated by inefficient spraying and labor-intensive practices.
What is it? (TIMP description)	The AGRAS T40, is drone designed with a Coaxial Twin Rotor configuration, allowing it to carry a 40 kg load for spraying and a 50 kg load for spreading (equivalent to 70 liters). It features a Dual Atomized Spraying System, DJI Terra software, Active Phased Array Radar, and Binocular Vision. This drone is capable of conducting various missions, primarily focused on precision pest and disease control operations, achieving even droplet distribution and more efficient pesticide usage and it can cover approximately 21.3 hectares of rice fields in an hour, making it a valuable tool for in pest and diseases management.
Justification	The cost of of application of pesticide in a large area is labour intensive and time consuming resulting into inefficiencies. The adoption of this technology for pesticides spraying is essential to address the inefficiencies in input distribution on the crop, which result in low yields. The AGRAS T40 is a secure and dependable drone, offering numerous advantages, such as extensive area coverage, reduced pesticide usage, labor efficiency, rapid response capabilities, and timely operations that prevent pest outbreaks from surpassing economic threshold levels.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Cooperatives, PCPB, Traders, Seed dealers, Drone Licensed companies and Agriprenuers.
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Initial capital to acquire drones requires financial investment • Requirement of licensing and training authorization from KCAA • Availability of internet connection for transmission of real time data • Technical training of extension and farmers on interpretation of prescription map details • Capacity building of the farmers and cooperative formation • Start-up companies for hire/availing services to the rice farmers
Partners/stakeholders for scaling up and their roles	• County government extension services; Provide link with farmers. • National Irrigation Authority (NIA) • Kenya Civil aviation Authority (KCAA) • Licensed drones operator and distributors • Community Interest Groups (CIGs) • Farmer cooperatives
C: Current situation and future scaling up	
Counties where already promoted, if any	Kisumu
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Changing weather conditions such as rain may hamper surveillance due to invisibility • Lack of credit facilities to purchase drones • Inadequate drone softwares in the country • Unavailability of 4G/5G internet connectivity to transmit real time data from rural areas • Lack of adequate technical training materials.
Recommendations for addressing the challenges	• Build technical capacity in precision agriculture for extension staff and farmers. • Farmers to form groups and work together to aggregate resources to purchase drones for surveillance • Credit facilities to access loan to purchase drones

	• Extension services and digital technology for information sharing • Government to continue distributing internet services in the rural areas where rice is grown for easy accessibility of network.
Lessons learned in upscaling, if any	• Precise data on occurrence of pests and diseases will reduce cost of inputs such as pesticides • Technical capacity of digital skills in rice management are required for realization for dissemination of precision agriculture.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in drone trainings to enhance adoption • Environmental: Highlight the research results showing the benefits of the use of drones to environmental safety, food safety and human health • Market conditions: Availability of drones close to the farmers is essential for their uptake. • Capacity build farmers on benefits of drones to create market demand • Policy: Provide enabling policy guiding and supporting the use of drones and review policy from time to time. Adoption of drone technology has potential since the government through KCAA act of 2020 has legalized drone operation against different activities including in agriculture. • Adoption of drone technology has potential to reduce intensive labour used in manual rice field scouting.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic cost for DJI-MAVIC-3-MULTI-SPECTRAL, = $19,999 equivalent to Kshs 2,799,860 @ exchange rate of Kshs 140.
Estimated returns	Returns on a minimum of 100 acre per season, 1 acre produces 6-8 bags @7000 per bag 17,500,000
Gender issues and concerns in dissemination, adoption and scaling	• Women and youth may have limited access to finances to buy the drones • Women have limited access to education, training and extension services.
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit to purchase drones • Employment opportunity exist for youths in operating the drones
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have less access to drone information, technology and knowledge. • VMGs may also have limited access to finances to buy the technology. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination of the technology. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit.

	• Employment opportunity exist for youths in operating drones
E: Case studies/profiles of success stories	
Success stories from previous similar projects	N/A
Application guidelines for users	**Reference** 1. Generalmanager@AERMATICA3D 2. Nayak, A. K. (2022). Advanced Techniques for Precision Farming in Rice. *Climate Resilient Technologies for Rice based Production Systems in Eastern India*. 3. Astral UAV service 4. CABI.org 5. DJI AGRICULTURE
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3. –requires further research**)**	2 - Requires validation
G: Contacts	
Contacts	Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO - Tabu R.O.
Partner organizations	NIA, KCAA, MOALD, Kenya Space Agency, Farmer cooperatives, Rice Millers

2.8.3 Leaf Wetness Sensor for Rice Diseases Monitoring

2.8.3 TIMPs name	**Leaf Wetness Sensor for Rice Diseases Monitoring**
	 Leaf wetness sensor
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	

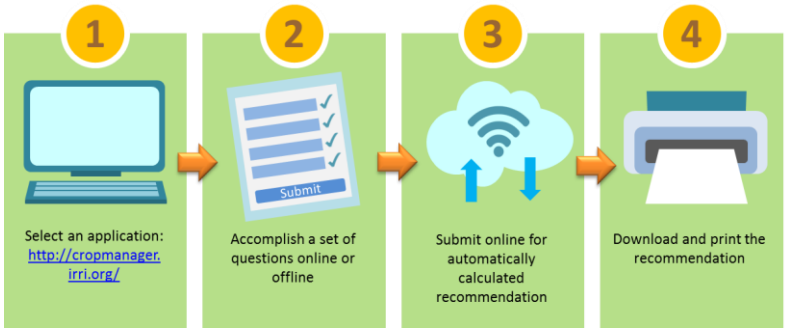
Problem addressed	Low ruice yield resulting from diseases
What is it? (TIMP description)	The Leaf Wetness Sensor is a precision calibrated device for detecting moisture on crop leaves. It prevents false detections with a non-hygroscopic coating. When connected to data loggers it provides data for disease management thus enabling timely crop spraying and moisture quantification to enhance agricultural practices.
Justification	Manual leaf wetness detection is labour intensive. The use of Leaf Wetness Sensors for monitoring rice diseases is essential as it eliminates the existing challenges in predicting disease stages in real-time. Rice is vulnerable to fungal diseases like rice blast and sheath blight which can lead to significant crop and yield losses. These sensors enable rice growers to monitor weather conditions such as temperature, humidity and moisture thus helping them align with disease development stages and make informed decisions on their management.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Cooperatives, PCPB, Traders, Seed dealers, Drone Licensed companies and Agriprenuers.
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals.
Critical/essential factors for successful promotion	• Availability of farmers with mobile phones or computers to access information from the sensor • Technical training of extension and farmers on interpretation of the collected and interpreted data for action • Capacity building of the farmers and Starter-up companies to stock affordable sensors
Partners/stakeholders for scaling up and their roles	• County government extension services; Provide link with farmers. • National Irrigation Authority(NIA) • Community Interest Groups (CIGs) • Farmer cooperatives • Digital agriculture startup companies • Irrihub-To provide efficient and affordable leaf wetness sensors
C: Current situation and future scaling up	

Counties where already promoted, if any	Kiambu
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Calibration and validation of a sensor per acre for data collectio requires skilled expertise • Unavailability of 4G/5G internet connectivity to transmit real time data from rural areas • Lack of adequate technical training materials.
Recommendations for addressing the challenges	• Build technical capacity in in precision agriculture from research levels to extensions and farmer (end user) • Farmers to form groups and work together and aggregate resources to purchase sensors for rice diseases forecast. • Credit facilities to structure their loans for smallholder farmers • Extension services and digital technology for information sharing • Government to continue distributing internet services in the rural areas where rice is grown for easy accessibility of network.
Lessons learned in upscaling, if any	• Real time forecast of disease data and provision of management practices will reduce cost of inputs • Technical capacity of digital skills in rice management are required for dissemination of precision agriculture technology.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in leaf wetness sensors training to enhance adoption • Environmental: Highlight the research results showing the benefits of using leaf wetness sensors to environmental safety, food safety and human health. It is environmental friendly and has inbuilt solar energy charging system. • Market conditions: Availability of leaf wetness sensors close to the farmers is essential for their uptake. • Capacity build farmers on benefits of leaf wetness sensors to create market demand • Policy: Provide enabling policy guiding and supporting the use of leaf wetness sensors and review policy from time to time. Adoption of ;eaf wetness sensors technology has potential in agriculture.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic cost for Leaf wetness sensor, = $195equivalent to Kshs 27,300 @ exchange rate of Kshs 140.
Estimated returns	Returns on a minimum of 100 acre per season, 1 acre produces 6-8 bags @7000 per bag 175,000
Gender issues and concerns in dissemination, adoption and scaling	• Women and youth may also have limited access to finances to buy the leaf wetness sensor technology. • Women have less access to leaf wetness sensor technology compared with men • Women have limited access to education, training and extension services.

Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit to purchase leaf wetness sensors • Employment opportunity exist for youths in operating the data loggers and extracting interpreted information.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have less access to leaf wetness sensors information, technology and knowledge. • VMGs may also have limited access to finances to buy the technology. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination of the technology. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit • Employment opportunity exist for youths in operating drones.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Pilot trial in smart farming in Kiambu for forecasting early and late blight diseases on tomatoes and hence action saved costs of operation by 20%.
Application guidelines for users	1. KALRO 2. Irrihub
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research**)**	2 - Requires validation
G: Contacts	
Contacts	Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org .
Lead organization and scientists	KALRO - Tabu R.O.
Partner organizations	NIA, KCAA, MOALD, Kenya Space Agency, Farmer cooperative Rice Millers

2.8.4 Rice Crop Manager

2.8.4 TIMPs name	**Rice crop Manager**
	Innovation

	 Steps to access Rice Crop Manager. Photo and information credit: https://www.irri.org
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Limited provision of personalized advice on crop and nutrient management to boost rice yield.
What is it? (TIMP description)	Rice Crop Manager is a web-based platform that provides field specific information on crop and nutrient management to increase yield and income for rice farmers. It uses computer algorithms to provide real-time advice on the right time, amounts and types of fertilizers needed. RCM recommendations are provided to farmers as a one page print out and as a Short Message Service (SMS) to guide crop management. In addition, it enables extension staffs on a computer/tablet or mobile phone prepare recommendations to farmers according to field requirements.
Justification	Real time and timely monitoring of nutition is important to reduce the cost of fertilizer in growing rice. Rice Crop Manager, a web-based tool, is handy in addressing yield variations and high input costs challenges. This tool offers timely field specific guidance tailored to unique needs of small-scale rice producers, accessible via web browsers on both PCs and cellphones. It aids extension workers, crop advisers and service providers deliver precise recommendations on nutrients, pests, weeds, and water management, depending on the rice variety, previous harvests and field-specific conditions.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Cooperatives, PCPB, Traders, Seed dealers, Drone Licensed companies and Agriprenuers.
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days

	• Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals.
Critical/essential factors for successful promotion	• Mobilization and sensitization of all the stakeholders • Availability of computers, tablets or mobile phone, internet connection for transmission of real time data • Technical training of extension and farmers on interpretation of site specific nutrient management • Capacity building of the farmers and cooperative formation.
Partners/stakeholders for scaling up and their roles	• County government extension services; Provide link with farmers. • National Irrigation Authority (NIA) • Community Interest Groups (CIGs) • Farmer cooperatives
C: Current situation and future scaling up	
Counties where already promoted, if any	None
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Availability of internet services to access information/advisory service • Lack of finances to print recommendations • Low literacy levels among rice farmers to implement the recommendation sent to their gadgets.
Recommendations for addressing the challenges	• Build technical capacity in in precision agriculture from research levels to extensions and farmer (end user). • Extension services and digital technology for information sharing • Government to continue distributing internet services in the rural areas where rice is grown for easy accessibility of network through the RCM.
Lessons learned in upscaling, if any	Technical capacity of digital skills in rice management required for realization of precision agriculture technology dissemination.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in rice crop manager training to enhance adoption • Environmental: Highlight the research results showing the benefits of using rice crop manager to environmental safety, food safety and human health • Market conditions: Availability of rice crop manager close to the farmers is essential for their uptake. • Capacity build farmers on benefits of rice crop manager to create market demand • Policy: Provide enabling policy guiding and supporting the use of rice crop manager and review policy from time to time.

	Adoption of rice crop manager technology has potential in agriculture.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic cost for training.
Estimated returns	Returns on a minimum of 100ha per season, 1ha produces 12-16 bags @7000 per bag 8,400,000.
Gender issues and concerns in dissemination, adoption and scaling	• Women and youth may also have limited access to finances to buy the technology. • Women have less access to technology compared with men • Women have limited access to education, training and extension services.
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Employment opportunity exist for youths in operating the drones
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have less access to information, technology and knowledge. • VMGs may also have limited access to finances to buy the technology. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination of the technology. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit. • Employment opportunity exist for youths in operating drones
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	https://www.irri.org/news-and-events/news/rice-crop-manager-advisory-service-rcmas-40-soft-launches-interoperable-digital
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upcaling
G: Contacts	
Contacts	Institute Director KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org.
Lead organization and scientists	KALRO, Ruth N., Tabu R.O..
Partner organizations	NIA, KCAA, MOALD, Kenya Space Agency, Farmer cooperatives, Rice Millers

2.8.5 Portable Weather Stations

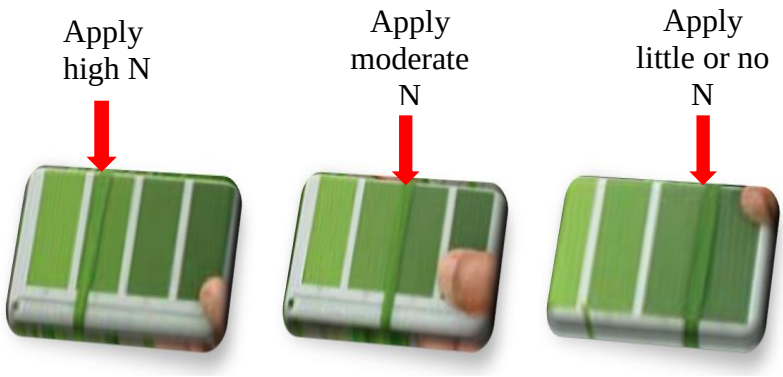
2.8.5 TIMPs name	Portable Weather Stations
	 Portable Weather station with sensors Photo credit: Crop Tracker
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Limited reliable weather information for rice farmers
What is it? (TIMP description)	A portable weather station is a digital sensor system with many data collection and transmission software. It is made up of parts, including soil moisture and temperature sensors, pyranometers for calculating plant evapotranspiration, rain gauges, thermometers and hygrometers all powered by solar batteries. It delivers real-time weather data essential for planning for planting, spraying, irrigation, and harvesting depending on temperature, wind speed, and soil conditions.
Justification	The variations in weather conditions and constraints of centralized, non-hyperlocalized weather information sources necessitate the use of portable weather stations. Current data sources frequently rely on lone weather stations situated at airports which might not fully reflect the actual conditions in rice fields where even slight variations in temperature or rainfall can have a significant effect on the crop. Accurate weather monitoring and forecasting from on-farm weather stations, has increased rice output along with operational effectiveness and cost savings.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Researchers, Cooperative, CIGs, Extension officers, Meteorological department of Kenya.
	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, CGIAR, NIA, Meteorological department of Kenya, Seed dealers and Agriprenuers.
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models

	• Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals.
Critical/essential factors for successful promotion	• Initial capital to acquire weather stations and installation requires financial investment • Technical capacity to implement collected and interpreted data • Availability of internet connection for transmission of real time data • Technical training of extension and farmers on interpretation of the gathered data • Capacity building of the farmers on the use of data
Partners/stakeholders for scaling up and their roles	• County government extension services - provide link with farmers. • National Irrigation Authority (NIA) • Community Interest Groups (CIGs) • Farmer cooperatives • Meteorological department of Kenya
C: Current situation and future scaling up	
Counties where already promoted, if any	Kiambu
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Inadequate local expertise to carry out advisory services in rice growing areas on data interpretation and implementation from the weather stations • Unavailability of 4G/5G internet connectivity to transmit real time data from rural areas • Lack of adequate technical training materials
Recommendations for addressing the challenges	• Build technical capacity in the use of data for researchers, extension staff and farmers • Farmers to form groups and aggregate resources to purchase 1 weather station for rice forecast • Credit facilities to provide loans to smallholder farmers • Extension serveices and digital technology for information sharing • Government to continue distributing internet services in the rural areas where rice is grown for easy accessibility of network.
Lessons learned in upscaling, if any	• Technical capacity of digital skills in data management • The information gathered from these portable weather stations can be used in many areas of production, including planting, harvesting, spraying, irrigation, and protection
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in portable weather station training to enhance adoption

	• Environmental: Highlight the research results showing the benefits of using portable weather stations to environmental safety, food safety and human health • Market conditions: Availability of portable weather stations close to the farmers is essential for their uptake. • Capacity build farmers on benefits of portable weather stations to create market demand • Policy: Provide enabling policy guiding and supporting the use of portable weather stations and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic cost for Portable weather station = $ 400 equivalent to Kshs 56000 @ exchange rate of Kshs 140.
Estimated returns	Returns on a minimum of 100 acre per season, 1 acre produces 6-8 bags @7000 per bag 17,500,000
Gender issues and concerns in dissemination, adoption and scaling	• Women and youth may also have limited access to finances to buy the weather stations technology. • Women have less access to weather station data and recommendations of the technology compared with men • Women have limited access to education, training and extension services.
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit to purchase portable weather stations. • Employment opportunity exist for youths in operating the portable weather stations.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have less access to portable weather stations information, technology and knowledge. • VMGs may also have limited access to finances to buy the technology. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination of the technology. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit. • Employment opportunity exist for youths in operating weather station software maintenance
E: Case studies/profiles of success stories	
Success stories from previous similar projects	In Kiambu, farmers have begun embracing portable weather stations that can predict important weather conditions in the wake of climate change in farming.
Application guidelines for users	1.CABI.org 2.Agricolus 3.XFARM

F: Status of TIMP readiness (1-ready for upscaling; -requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	Institute Director KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO - Tabu R.O.
Partner organizations	NIA, KCAA, MOALD, Kenya Space Agency, Farmer cooperatives, Rice Miller

2.8.6 Leaf Color Charts

2.8.6 TIMPs name	**Leaf Color Charts**
Category (i.e. technology, innovation or management practice)	 Leaf colour Chart Source: Dr. Daniel Menge
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of a rapid diagnostic tool to detect nitrogen and enhance rice nutrition for Optimum rice growth.
What is it? (TIMP description)	A Leaf Color Chart (LCC) is a practical diagnostic tool used to assess the nitrogen level in rice plants by comparing the color of their leaves to standardized color panels. Typically, the LCC is a rulershaped strip with color panels ranging from yellowish green to dark green. The LCC aids in determining the appropriate amount of nitrogen fertilizer required for optimal plant health. To use the LCC effectively, select healthy rice plants, compare their leaf color to the LCC's color panels, and calculate an average reading. The intensity of leaf color on the LCC corresponds to the nitrogen's relation to photosynthesis and the available nitrogen amount.

Justification	Leaf color charts are essential due to limitations of expensive farmer-led technology in identifying nitrogen deficiencies, which have an impact on the precise and ineffective distribution of nitrogen fertilizer. In turn, this results in the over usage of nitrogen, which raises greenhouse gas emissions. The Leaf Color Chart (LCC) provides a quick and reasonably priced diagnostic method for assessing rice leaf color and acting as a reliable indicator of the nitrogen status of the plant. Optimizing photosynthesis, biomass output, and crop nitrogen requirement during the growing season requires an understanding of the nitrogen status of rice leaves. The LCC offers a quick and effective way to assess the nitrogen status of leaves and direct nitrogen fertilizer application, promoting excellent rice yields while reducing input requirements.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, CGIAR, NIA, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Provision of leaf color charts from Rice knowledge bank for training and practical activities.
Partners/stakeholders for scaling up and their roles	• County government extension services; Provide link with farmers. • Common Interest Groups (CIGs) • Farmer cooperatives • Agro-dealers
C: Current situation and future scaling up	
Counties where already promoted, if any	Kirinyaga
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay

Challenges in dissemination	• Inadequate local expertise to carry out extension services • Availability of technical training materials
Recommendations for addressing the challenges	• Build technical capacity in precision agriculture from research levels through the extensions and farmer (end user). • Farmers to form group and work together as it has been in the past aggregation resources to use leaf color charts.
Lessons learned in upscaling, if any	• Farmers to create F to F training to create awareness in use of LLC.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in leaf colour charts training to enhance adoption • Environmental: Highlight the research results showing the benefits of using leaf colour charts to environmental safety, food safety and human health. Reduction in excessive use of N will drastically decrease environmental footprint. • Market conditions: Availability of leaf colour charts close to the farmers is essential for their uptake. • Capacity build farmers on benefits of leaf colour charts to create market demand • Policy: Provide enabling policy guiding and supporting the use of leaf colour charts and review policy from time to time. Adoption of leaf colour charts technology has potential in agriculture.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic cost for Portable weather station = None
Estimated returns	Returns on a minimum of 100 acre per season, 1 acre produces 6-8 bags @7000 per bag 17,500,000
Gender issues and concerns in dissemination, adoption and scaling	• Women have less access to LLC data and recommendations of the technology compared with men • Women have limited access to education, training and extension services.
Gender related opportunities	• Employment opportunity exist for youths in operating the drones
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination of the technology. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	VMGs have advantage to work as LLC experts since its not labour intensive
E: Case studies/profiles of success stories	
Success stories from previous similar projects	N/A
Application guidelines for users	**Reference** • IRRI.ORG • Win, C. S. (2018). A Study On Paddy Production In Myanmar (From 2007/2008 to 2016/2017) (Doctoral dissertation, Yangon University of Economics).

F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO - Tabu R.O..
Partner organizations	NIA, KCAA, MOALD, Kenya Space Agency, Farmer cooperatives, Rice Millers

2.8.7 SPAD Chlorophyll-Meter

2.8.7 TIMPs name	SPAD chlorophyll-meter
Category (i.e. technology, innovation or management practice)	 SPAD CHLOROPHYLL METER Photo credit: konicaminolta.eu
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Absence of a rapid and precise technology for site-specific nutrient application in rice fields for optimum yeilds.
What is it? (TIMP description)	A SPAD Chlorophyll Meter is a hand held device used to detect chlorophyll concentrations in plant leaves in a quick, precise, and non-invasive manner. It works by measuring light absorbance in two distinct wavelength ranges of red and near-infrared. The meter derives a numerical SPAD value by examining the absorbance data from these locations and providing an accurate depiction of the chlorophyll concentration in the leaves. It is is useful for checking plant health and nutritional status without inflicting any harm to the plant.
Justification	SPAD chlorophyll meter is crucial tool due to the current scarcity of precise N level assessment tools for rice fields. The scarcity has lead to inefficient nitrogen-based fertilizer application, causing environmental and agricultural issues. Traditional approaches are limited in their effectiveness, necessitating the introduction of tools like the SPAD chlorophyll meter for rice farmers. Accurate N level assessment is vital for optimizing rice growth, and the SPAD meter's rapid and reliable chlorophyll-based identification significantly improves the efficiency and sustainability of fertilizer application.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, CGIAR, NIA, Seed dealers and Agriprenuers

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Availability of SPAD chlorophyll meter
Partners/stakeholders for scaling up and their roles	• County government extension services; Provide link with farmers. • Community Interest Groups (CIGs) • Farmer cooperatives • Agro-dealers
C: Current situation and future scaling up	
Counties where already promoted, if any	Kirianyaga
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Inadequate local expertise to carry out extension services • Availability of technical training materials
Recommendations for addressing the challenges	• Build technical capacity in precision agriculture from research levels through the extensions and farmer (end user). • Farmers to form group and work together as it has been in the past aggregation resources to use leaf color charts.
Lessons learned in upscaling, if any	• Farmers to create F to F training to create awareness in use of LLC.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in chlorophyll meter training to enhance adoption • Environmental: Highlight the research results showing the benefits of using chlorophyll meter to environmental safety, food safety and human health. Reduction in excessive use of N will drastically decrease environmental footprint. • Market conditions: Availability of chlorophyll meter close to the farmers is essential for their uptake. • Capacity build farmers on benefits of chlorophyll meter to create market demand • Policy: Provide enabling policy guiding and supporting the use of chlorophyll meter and review policy from time to time. Adoption of chlorophyll meter technology has potential in agriculture.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic cost for Portable weather station=Kshs 20,0000
Estimated returns	

Gender issues and concerns in dissemination, adoption and scaling	• Women have less access to SPAD equipment's and recommendations of the technology compared with men • Women have limited access to education, training and extension services.
	Employment opportunity exist for youths in operating the SPAD chlorophyll meter
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination of the technology. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	• VMGs have advantage to work as LLC experts since it's not labour intensive
E: Case studies/profiles of success stories	
Success stories from previous similar projects	N/A
Application guidelines for users	• https://www.konicaminolta.com/instruments/download/catalog/color/pdf/spad502plus_catalog_eng.pdf
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO - Tabu R.O.
Partner organizations	NIA, KCAA, MOALD, Farmer cooperatives

2.8.8 The Tensiometer

2.8.8 TIMPs name	**The Tensiometer**
Category (i.e. technology, innovation or management practice)	 **Jet Fill Tensiometer**  **Tesiometer in a rice field** **Source: Dr. Lusike Wasilwa**

Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Inefficient irrigation scheduling in rice farms causing either over and under irrigation challenges.
What is it? (TIMP description)	A tensiometer is a rapid diagnostic devise that is used to monitor water use in irrigated rice fields. It is used for measuring groundwater tension in soil. It comprises of a cylindrical tube, approximately one inch in diameter, featuring a porous ceramic cup at one end and a vacuum gauge connected to a set of embedded sensors, software, and other technologies referred to as the Internet of Things (IoT).
Justification	In irrigated rice fields, poor water management can diminish yields and negatively impact grain quality. Tensiometers provide consistent, easy-to-interpret readings, revealing important information about soil moisture conditions at the root level. These metrics can be used with IoT technology to allow for real-time data transmission, enhancing irrigation decision support. Tensiometers also enable automatic and efficient irrigation in rice fields when combined with monitoring systems such as transformers, ensuring optimal water management and crop health.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, CGIAR, NIA, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Availability of Tensiometer in rice growing areas • Availability of training materials for purposes of technology and knowledge transfer.
Partners/stakeholders for scaling up and their roles	• County government extension services; Provide link with farmers. • Community Interest Groups (CIGs) • Farmer cooperatives • Agro-dealers • National Irrigation Authority. •
C: Current situation and future scaling up	

Counties where already promoted, if any	Kiambu
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Inadequate local expertise to carry out extension services • Availability of technical training materials.
Recommendations for addressing the challenges	• Build technical capacity in precision agriculture from research levels through the extensions and farmer (end user). • Farmers to form group and work together as it has been in the past aggregation resources to use leaf color charts.
Lessons learned in upscaling, if any	• Farmers to create F to F training to create awareness in use of tensiometer linked with IOTs in rice farming areas as model of upscaling • Creation of several pilot sites in rice growing areas
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in tensiometer training to enhance adoption • Environmental: Highlight the research results showing the benefits of using tensiometer to environmental safety, food safety and human health. • Market conditions: Availability of tensiometer close to the farmers is essential for their uptake. • Capacity build farmers on benefits of tensiometer to create market demand • Policy: Provide enabling policy guiding and supporting the use of tensiometer and review policy from time to time. Adoption of tensiometer technology has potential in agriculture.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Basic cost for Portable Tensiometer + IOTs=Kshs 70000
Estimated returns	
Gender issues and concerns in dissemination, adoption and scaling	• Women have less access to Tensiometer equipment's and recommendations of the technology compared with men • Women have limited access to education, training and extension services. • Employment opportunity exist for youths in operating the Tensiometer installation and decision support system implementation
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination of the technology. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	VMGs have advantage to work as tensiometer monitoring experts since it's not labour intensive
E: Case studies/profiles of success stories	
Success stories from previous similar projects	N/A

Application guidelines for users	**Reference** Bhatt, R., Hossain, A., Busari, M. A., & Meena, R. S. (2021). Water footprint in rice-based cropping systems of South Asia. Agro ecological Footprints Management for Sustainable Food System, 273-308.
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO – Tabu R.
Partner organizations	NIA, MOALD, Farmer cooperatives, Rice Millers

2.8.9 Bird Scarer

TIMP Name	**Bird Scarer**
	Technology  
Category (i.e. technology, innovation or management practice)	**Technology**
A: Description of the technology, innovation or management practice	
Problem to be addressed	Yield loss of upto 80% due to bird damage.
What is it? (TIMP description)	Bird scaring involves a range of strategies and technologies used to deter pest birds from causing crop damage or other nuisances. Scarecrows which are life-size models resembling predatory birds and reflective objects designed to shock or intimidate birds can be used as one of the strategies used in the management of birds in rice. .
Justification	Bird Scaring can reduce the damage caused by birds such as Quelea quelea, which can consume up to 80 of the rice grain. Farmers suffer significant yield losses if these birds are not controled
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, CGIAR, NIA and Agriprenuers

Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Involve farmer groups in dissemination • SACCO's supporting rice growing areas. • Introduction of several variaties of devices • County and Central government support for policy formulation.
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services ATDC's, • CaDPERP, KALRO, research organizations Farmers/farmer groups • Central and County governments, e.g. Agricultural Extension (Formal and informal) for policy, awareness and dissemination • Kenya School of Agriculture • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• only known method is throwing stones and making noise at birds • No mechanical, electronic and chemical devices available in the market • Demand for devices has not been there before
Suggestions for addressing the challenges	• Explore, introduce and test other methods of bird scaring
Lessons learned in upscaling if any	• None yet but some individual farmers own similar equipment
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in bird scarer training to enhance adoption • Environmental: Highlight the research results showing the benefits of using bird scarer to environmental safety, food safety and human health. • Market conditions: Availability of bird scarer close to the farmers is essential for their uptake. • Capacity build farmers on benefits of bird scarer to create market demand

	• Policy: Provide enabling policy guiding and supporting the use of bird scarer and review policy from time to time. Adoption of bird scarer technology has potential in agriculture.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To scare birds for 1 month it will vost 30 days @ KES 500 resulting to KES 15000 per acre.
Estimated returns	• 1 acre of rice gives on avarege of 30 bags. Losing 80% of this results into losing 24 bags remaining 6 bags giving returns of 6 @ KES 4500 yeilding KES 27,000 • •
Gender issues and concerns in development, dissemination, adoption and scaling up Dissemination	• No that would compromise dissemination and upscaling
Gender related opportunities	• Saves time and money because no physical presence required in the field. Allows time for other gender roles in respective farmilies
VMG issues and concerns in development, dissemination, adoption and scaling up	• Potential of creativity/production of the devices thus increasing employment opportunities, improving productivity and income for women and youth • Has potential to improve food security and nutrition for women and youth
VMG related opportunities	
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	
F: Status of TIMP readiness (1-ready for upscaling 2-requires validation; 3-requires further research**)**	2 - Requires validation
G: Contacts	
Contacts	1. CaDPERP Mwea Email;- ricemapp@gmail.com 2. State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo hq's P.o. Box 30028 – 00100 NAIROBI E-mail: info@kilimo.go.ke Telephone: +254-20-2718870 Hotline: 0800724891 www.kilimo.go.ke Regional ATDC's
Lead organization and Scientists	KALRO – Tabu R.
Partner organizations	MOALD (CaDPERP Mwea), FAO, IRRI

2.9 CROP HEALTH

2.9.1 Integrated Management of Grasshopper (*Othoptera:Acrididae*) in upland rice culutres

2.9.1 TIMP Name	**Integrated Management of Grasshopper (Othoptera:*Acrididae*) in upland rice culutres**
	 Source. CABI Plantwise knowledge bank.  Source: IRRI Rice knowledge bank.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields in rice production due to infestation by grasshoppers leading to 18% yield reduction.
What is it? (TIMP description)	Integrated Pest Management of Grass hoppers in rice ecosystem includes combined use of cultural practices, biological control, resistant cultivars and synthetic pesticides. **Management Strategy** The following management options are recommended: **Cultural practices:** • Avoid planting alternate host plants near rice crop. • Remove weeds from bunds & water channels, to destroy the egg pods. **Other management options:** • Use Neem-based biopesticides e.g. Nimbecidine, Achook, or Neemraj Super according to manufacturer's recommendations • Spray using Alpha-cypermethrin based products according to the manufacturer recommendations. **Note:** Agro-chemicals should be used in consultation with professional practitioners and considering existing cautionary/safety measures, particularly the manufacturer's instructions.

Justification	The rice grasshoppers are an important pest in rice production and can cause up to 18% yield loss if not controlled. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD & I – Provide and up-scaling of agricultural research and extension service at the national level;

	development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted.

	• Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of purchase of pesticide, scouting and spraying is Ksh 2500.00 and two manday at KES 1000 =3500
Estimated returns	Return 5bags/acre at Ksh 4000 per bag= 20,000.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in planting, weeding and spraying which is mostly done by women and youthy • Land ownership in rice is mainly by men who make the decision on management practices to adapt, while women and youth are mainly the implementers • Financial empowerment, the poor farmers lack funds to acquire IPM inputs • Limited access to knowledge on IPM by women and youth involved in rice production compared to men • Slow information and lack of awareness of female farmers due to low academic levels • Women and youth may not be able to reach far way markets or have bargaining power • Limited youth opportunities in in rice value chain • The training materials and strategies may not be favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM strategies are possibl • These are women and youth friendly production techniques relevant to IPM including agrodealers e.t.c.

	• Empower women and youth to acquire land and other inputs such as biopesticides, appropriate varieties and certified/clean planting materials • Well organized gender friendly markets and marketing system • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious pest and disease management practices • IPM dissemination methods and documents that are not always easy to understand or access • Low access to IPM sources and information • Financial constraints • Integrated management of the pest and diseases reduces production costs therefore VMG's can afford to produce pyrethrum with low-income inputs. Safety of VMG's is taken into account
VMG related opportunities	• Affordable IPM strategies for rice • Make friendly IPM training materials with illustrations to enhance communication • Well organized friendly IPM trading conditions • Make friendly training materials with illustrations to enhance communication • Well organized friendly trading conditions • Integrated management of the pest reduces production costs therefore VMG's can afford to produce rice with low-income inputs. • Safety of VMG's is taken into account through minimizing unnecessary use of synthetic pesticides • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank **3.** FAO. 2022. Handbook on the integrated crop management of rice and paddy for farmer field schools in central dry zone of Myanmar. Nay Pyi Taw. https://doi.org/10.4060/cc1163en 4. Banwo, O.O. (2002): Management of major insect pests of rice in Tanzania. Plant Protect. Sci., **38**: 108–113. 5. Pest Control Products Board List of registered products (www.pcpb.co.ke)
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G. Contacts	

Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	**KALRO, IRRI AfricaRice, NIA, MoALP**

Gaps:

- Explore bio-control options for management of grasshopers
- Explore the efficacy of bio-pesticides and ITKs in pest management at different stages of the grasshopers pest
- Validation of tolerance of new varieties to the pest

2.9.2 Integrated Management of Mole Crickets in upland rice

2.9.2 TIMP Name	**Integrated Pest Management of Mole Crickets in upland rice**
	  **Source: IRRI rice knowledge bank**
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem to be addressed	Damage by mole crickets causes 18 % yield loss of rice resulting into reduced productivity. They destroy rice by feeding on seeds, tillers, roots resulting in to loss of plants.
What is it? (TIMP description)	Integrated pest management of crickets in rice ecosystem includes various combinations of cultural practices, biological control, resistant cultivars and synthetic pesticides. **Management Strategy** The following management options are recommended: **Cultural practices:** • Avoid sowing alternate host plants near rice crop • Remove weeds in the farm and clear bushy areas around fields to reduce habitat areas and populations of moles attacking the crop

	• Remove cereal heads, maize cobs, and/or tubers from neighbouring fields after harvest to reduce breeding sites • Use combination of using traps and decoy baits to trap moles • Put water barriers around the rice fields • Plant *Tephrosia vogelii* randomly throughout the field and along the borders to poison mole-rats when feeding. • Use a mixture of cow dung and pepper in burrows and burn to smoke out the moles • Pour one-week old fermented cattle urine on bunds to chase away moles • Dig deep ditches around field plots e.g., sweet potato plot, to stop mole-rats from tunnelling straight into the field • Set traps (snap, snare or live) within affected fields.
Justification	The mole criket damage causes loss in rice and compromises plant population resulting in low grain yield. They feed on the underground parts of upland rice and where the pest is severe and not controlled losses of up to 18% may be observed. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies

	• A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO, Industrial Crops Research Institute Institutes (ICRI-Mwea) and International research organizations e.g. The International Rice Research Institute (IRRI)) – to provide tolerant varieties, seed and IPM information • Market players – to create a demand and pull production of IPM strategies • Farmers/farmer groups – to create awareness and adopt IPM practices • Agrodealers – to enhance availability, accessibility of IPM products at affordable prices • County and National governments– to formlate policies that promote the use of IPM practices • NGOs – for organizing and mobilizing farmers • Seed companies – for quality seed multiplication • Financial institutions e.g. Banks, donors and other credit facilitators to provide financial solutions in promotion of IPM practices
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.

Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Kes 18500.00
Estimated returns	Kes 81500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in planting, weeding, spraying which is mostly done by women or youth • Limited knowledge on IPM by women, youth and men farmers limits understanding and hence adoption • Limited access to finances to purchase IPM products by women and youth • Land resources in rice production is often owned by men who are mostly not involved in rice production

	• Women and youth may not acces agroverts with IPM products
Gender related opportunities	• Opportunities for women and youth to gain meanful employment in the implemention of IPM practices • Empower women and youth to acquire land and IPM inputs • Reach more women groups with the information on IPM for pest management • Avail well organized gender-friendly markets and marketing system for IPM components and outputs • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious pest and disease management practices • Dissemination of IPM methods and documents that are not always easy to understand or access • Few IPM inputs and output markets (for sale of quality produce) • Financial constraints to facilitate affordability of IPM practices
VMG related opportunities	• Affordable IPM strategies for management of the pest in upland rice cultivation • Make IPM VMG-friendly training materials with illustrations to enhance communication • Well organized friendly trading conditions • Empower the VMGs by connecting them to financial sources • Integrated management of the pest reduces production costs therefore VMG's can afford to produce rice with low-income inputs. Safety of VMG's is therefore jtaken into account
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Promotion of use of IPM practices in plant clinics operating in rice irrigation schemes of Bunyala, Ahero, West Kano, Lower Kuja. Mwea and Vanga.
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank 3. Pest Control Products Board List of registered products (www.pcpb.co.ke) 4. IRRI Rice knowledge bank
F: Status of TIMP readiness (1-ready for upscaling, 2- requires validation; 3-requires further research**)**	1- Ready for upscaling
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100

Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	**KALRO, IRRI AfricaRice, NIA, MOALD**

Gaps:

- Explore bio-control options for management of crickets
- Explore the efficacy of bio-pesticides and ITKs in pest management at different stages of the crickets pest
- Validation of tolerance of new varieties to the pest

2.9.3 Integrated Management of Rice Sucking bugs(*Asparia sp. Stenocorus spp* and *Mirperus spp*)

2.9.3 TIMP Name	**2.8.3Integrated Management of Rice sucking bugs (*Asparia* sp. *Stenocorus spp* and *Mirperus spp*)**
	 Source: Rice knowledge bank IRRI
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	This pest causes yield loss of 30 % and lowers the quality of rice if not managed. They suck contents from the grain resulting in to unfilled or empty and discolored rice grains.
What is it? (TIMP description)	Integrated pest management strategies of rice sucking bug involves application of a combination of cultural, biological and chemical control. IPM approaches. are effective, gender sensitive, economically and environmentally friendly practices. They safeguard the environment, improve crop yields and increase farm incomes. **Management Strategy** The following management options are recommended:

	Cultural practices: If possible, use late-maturing varieties to avoid the period of peak pest population Synchronous planting of rice to help in reducing rice bug problems Monitor fields for signs of the pest, starting from pre-flowering stage Remove alternative hosts such as grass weeds and beans Carry out earth sprays of diatomaceous powder – the chalky powder is a natural sedimentary rock that contains silica, alumina, and iron oxide Spray using garlic or mint to repel the stink bug Spray using soapy water **Biological Control** Use Neem-based biopesticides e.g. Nimbecidine, Achook, or Neemraj Super according to manufacturer's recommendations. Spray the affected plants with a biopesticide that is effective against the pest, e.g. Beauvitech WP or Lecatech WP or Bacillus thuringiensis based products e.g. Baciguard 16 WDG, 35 WP, Halt 50 WP to effectively manage this pest. **Chemical management:** Use of soft pyrethrin sprays/insecticides can be recommended as a last resort for control of sucking bugs at heading (flowering) and milk stages, the most susceptible stages of rice to sucking and stink bug (www.pcpb.go.ke) **Note:** *Agro-chemicals should be used in consultation with professional practitioners and considering existing cautionary/safety measures, particularly the manufacturer's instructions.*
Justification	Rice sucking bugs cause yield losses in rice and compromise its quality. In severe infestation, they can reduce yield by 30%. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access to products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders

	• Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	Ksh 18500.00
Estimated returns	Ksh 81500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth • Limited knowledge by farmers, especially women and youth, of the pest, its alternative host plant and IPM options for its management • Land ownership and decision making mainly by men who may have no knowledge or interest in IPM • Financial empowerment, the poor farmers lack funds to acquire biopesticides and other IPM inputs • Slow information and awareness flow to female farmers due to academic levels • Limited youth opportunities in rice value chain • The training materials and strategies may not always be favorable and accessible to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with sufficient technical knowledge for various operations. • Packaging of women and youth friendly production techniques on IPM • Empower women and youth to acquire land and other inputs such as improved varieties and seed • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious pest and disease management practices • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication • Well organized VMG-friendly trading conditions • Empower the VMGs by connecting them to financial sources • Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness	1 - Ready for upscalling

(1-ready for upscaling; 2-requires validation; 3-requires further research**)**	
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Real IPM, Dudutech, IRRI, AfricaRice, Pesticide companies, MRGM, NIA registered Seed producers, KEPHIS, MOALD , Agricultural University Colleges, ICIPE, CABI

Gaps:

- Explore bio-control options for management of rice suking pests
- Explore the efficacy of bio-pesticides and ITKs in pest management at different stages of the rice sucking pest
- Validation of tolerance of new varieties to the pest

2.9.4 Integrated Management of Green Stink bugs (*Nezara viridula*)

2.9.4 TIMP Name	**Integrated Management of Green Stink bugs *Nezara viridula***
	• Use row covers • Hand pick the pest • Use pheromone traps, • Use trap crops to attract the pest • Use natural enemies • Early weeding of graminaceous weeds, which are alternate hosts for green rice bugs The use resistant varieties against the green rice bug. 
Category (i.e. technology, innovation or management practice)	Management practice

A: Description of the technology, innovation or management practice	
Problem to be addressed	Reduced yield of 24% and quality of rice due to infestation of the green rice bug.
What is it? (TIMP description)	• Integrated pest management of rice green bug involves application of a combination of various control options (cultural, biological and chemical) simultaneously to manage the pest. These approach include: o Cultural practices o Biological control o Use of biological bio-pesticides using Beauveria bassiana Vuillemin against the green rice bug. o Use parasitic wasp in the family Scelionidae, Telenomus podisi (Ashmead) (Hymenoptera) to parasitize green rice bug eggs o Spraying botanicals such as neem and pyrethrum extracts when caterpillars are small o Spray using Bacillus thuringiensis v. kurstaki formulations 2% @2g/l or Metarhizium anisopliae or Beauveria bassiana @ 5 g/ litter at 5-10% infestation. Repeat the spray based on weekly scouting at >10% fresh infestation. o Chemical management o Foliar application of pyrethroids is effective in suppressing green rice bug populations.
Justification	The green rice bug causes yield losses in rice and compromises its quality. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models

	• Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print Publications -posters/brochures/leaflets, manuals. •
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space

	• Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling, if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ksh 18500.00
Estimated returns	Ksh 81500.00

Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth • Limited knowledge by farmers, especially women and youth, of the pest, its alternative host plant and IPM options for its management • Land ownership and decision making mainly by men who may have no knowledge or interest in IPM • Financial empowerment, the poor farmers lack funds to acquire biopesticides and other IPM inputs • Slow information and awareness flow to female farmers due to academic levels • Limited youth opportunities in rice value chain • The training materials and strategies may not always be favorable and accessible to women farmers.
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with sufficient technical knowledge for various operations. • Packaging of women and youth friendly production techniques on IPM • Empower women and youth to acquire land and other inputs such as improved varieties and seed • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious pest and disease management practices • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication • Well organized VMG-friendly trading conditions • Empower the VMGs by connecting them to financial sources • Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	•
Application guidelines for users	• http://www.knowledgebank.irri.org/ • CABI Plantwise Plus Knowledge Bank • Pest Control Products Board List of registered products (www.pcpb.co.ke)

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research**)**	2 - Requires validation
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	KALRO, IRRI AfricaRice, NIA, MoALP

Gaps:

- 1. Explore bio-control options for management of green stink bugs .
- 2. Validation of tolerance of new varieties to the pest
- 3. Explore the efficacy of bio-pesticides and ITKs in pest management at different stages of the green stink bugs

2.9.5 Integrated Management of Rice Leaf Folders (*Cnaphalocrocis medinalis, Guenee*)

2.9.5 TIMP Name	**Integrated Management of Rice leaf folders (*Cnaphalocrocis medinalis, Guenee*)**
	  Leaf damaged by leaffolder  Larva folding the leaves *Source: IRRI Rice Knowledge Bank*
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Reduced rice productivity by 10% if the leaf folder is not managed
What is it? (TIMP description)	Integrated management of Rice leaf folders (*Cnaphalocrocis medinalis*, Guenee) is a combination of various cultural, biological and chemical control. These include: **Cultural practices:** • Avoid excessive nitrogenous fertilizer • Keep the bunds clean **Biological control:**

	• *Release Trichogramma chilonis* (egg parasitoid of rice leaf folder) thrice (at 37, 44 and 51 days) after transplanting. • Spray neem based insecticides **Chemical control**: • Apply recommended insecticides if there's 10% leaf damage at vegetative phase and 5% of flag leaf damage at flowering • Spray recommended pesticide such as CartapHydrochloride 50 % SP 400 g/ac www.pcpb.go.ke
Justification	The pest has the ability to defoliate the leaves leading to considerable reduction in yield. If this happens at the reproductive stage of the plant it will cause economically significant yield loss. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, NIA, Extension Agents (Public and Private), Research Organizations and Universities, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications - posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM

	• Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be upscaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides

	• Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 48500.00
Estimated returns	KES81500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth • Increased pest population with adoption of better rice production practices leading to increased demand on women and youth on their time • Land ownership and decision making in rice production is mainly by men while practices are mainly carried out by women • Limited access to finances especially by women and youth to acquire inputs • Slow information and awareness flow to female farmers due to academic levels

	• The training materials and strategies are often not favorable or accessible to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with sufficient technical knowledge for various operations. • Packaging of women and youth friendly production techniques on IPM • Empower women and youth to acquire land and other inputs such as improved varieties and seed • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious pest management practices • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication • Well organized VMG-friendly trading conditions • Empower the VMGs by connecting them to financial sources • Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Youths acquire spraying equipment from microfinance institutions and combined harvestors in Mwea Irrigation scheme through LAINISHA SACCO.
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank 3. Pest Control Products Board List of registered products (www.pcpb.co.ke)
F: Status of TIMP readiness **(**1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 - Ready for upscaling
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100

Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	**KALRO, IRRI, AfricaRice, NIA, MoALP**

Gaps:

- Explore bio-control options for management of rice leaf folder .
- Explore the efficacy of bio-pesticides and ITKs in pest management rice leaf folder
- Validation of tolerance of new varieties to the pest

2.9.6 Integrated Management of Rice Case Worm Nymphula depunctalis

2.9.6 TIMP Name	**Integrated Management of Rice Case Worm (*Nymphula depunctalis0***
	 
	Source: IRRI Rice knowledge bank
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem to be addressed	Reduced productivity of 10% due to pest damage on the plant.
What is it? (TIMP description)	Integrated management of rice caseworm consists of combination of cultural, biological and chemical control methods include. This includes: **Cultural control** • Manage the water by maintaining the level at 3-7cm water during the first 30 days after transplanting • Encourage the growth of Azolla weed **Biological Contro:** Release egg parasitoid *Trichogramma* spp at a rate of 50,000 to 100,000 eggs/acre **Chemical control:** • Spray using Alpha-Cypermethrin 100 g/ litres (e.g. Bestox) according to the manufacturers recommendation. • Use recommended pesticides – check pesticide control product board list on: www.pcpb.go.ke
Justification	Rice caseworm infestation in rice field reduces yield by causing defoliation causing stunted growth. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production

	considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of

	standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	• Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	• Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits

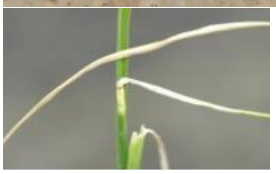
	• Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time. •
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES18500.00
Estimated returns	KES 81500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth • Increased pest population with adoption of better rice production practices leading to increased demand on women and youth on their time • Land ownership and decision making in rice production is mainly by men while practices are mainly carried out by women • Limited access to finances especially by women and youth to acquire inputs • Limited knowledge on scouting and identification of various pests by women and youth working on rice fields • The training materials and strategies are often not favorable or accessible to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with sufficient technical knowledge for various operations. • Packaging of women and youth friendly production techniques on IPM • Empower women and youth to acquire land and other inputs such as improved varieties and seed • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the gender-friendly FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious pest and disease management practices • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM • Limited knowledge on pest scouting, identification and management

	• Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs •
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication • Well organized VMG-friendly trading conditions • Empower the VMGs by connecting them to financial sources • Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	• http://www.knowledgebank.irri.org/ • CABI Plantwise Plus Knowledge Bank • Pest Control Products Board List of registered products (www.pcpb.co.ke)
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 – Ready for upscaling
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	**KALRO, IRRI AfricaRice, NIA, MoALP**

Gaps:

- Explore bio-control options for management of rice caseworm .
- Explore the efficacy of bio-pesticides and ITKs in pest management rice caseworm
- Validation of tolerance of new varieties to the pest

2.9.7 Integrated pest management of Rice whorl maggot

2.9.7 TIMP Name	Integrated pest management of Rice whorl maggot
	     Clockwise from top: 1-Adult on a leaf 2-Adult 3-The maggot 4,5 – Damaged plants *Source: IRRI Rice Knowledge bank*
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Reduced yield of 10% due to damage of this pest.
What is it? (TIMP description)	Integrated pest management for rice whorf maggot comprises of cultural, biological and chemical control practices. **Cultural practices** • Manage the water level to avoid leaf contact with water. • Encourage direct seeding and not by transplanting • Draining the fields at intervals for 3 to 4 days during the first 30 days. • Use rice varieties that emerge erect and grow quickly. The flies are more attracted to standing water. • Encourage cover of Azolla to control whorl maggots • Inspect neighboring fields that were planted 1 week ahead for manifestation of damaged leaves and dead heart. **Biological control:** • Encourage predators- wasps parasitize on eggs and the maggots; dolicopodid flies prey on the eggs; ephydrid flies and spiders feed on the adults • Use bio-pesticides such as neem based products (Achook 8.1l/ha, Nemason 10l/ha, Nimbecidine 600ml/20l of water)
Justification	This pest can cause up to 10% yield loss in rice if not controlled. The infestation by this pest also compromises the crop quality. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their

	overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals •
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.

C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption

	• Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 18500.00
Estimated returns	KE81500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limited access to knowledge and information on IPM by various gender groups • Where there is disjoint between gender involved in decision making regarding pest management this affects implementation of IPM in management of the pest • Limited access to finances to access the IPM components by men, women and youths involved in rice production • Slow information and awareness flow to female farmers due to academic levels • Limited involvement of youth in rice value chain • The training materials and strategies may not always be favorable to women farmers
Gender related opportunities	• Opportunities exist for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Empower women and youth to acquire production inputs necessary for IPM including improved varieties e.t.c. • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious pest management practices • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication • Well organized VMG-friendly market access conditions • Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account • Empower the VMGs by connecting them to financial sources

E: Case studies/profiles of success stories	
Success stories from previous similar projects	• None
Application guidelines for users	• http://www.knowledgebank.irri.org/ • CABI Plantwise Plus Knowledge Bank • Pest Control Products Board List of registered products (www.pcpb.co.ke)
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1- Ready for upscaling
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	KALRO, IRRI AfricaRice, NIA, MoALP

Gaps:

1. Explore bio-control options for management of rice whorl maggot
2. Explore the efficacy of bio-pesticides and ITKs in pest management at different stages of the rice whorf magot
3. Validation of tolerance of new varieties to the pests

2.9.8 Integrated management of white rice stem borer (*Mariapha seperatela*)

2.9.8 TIMP Name	Integrated management of White Rice Stem Borer (*Mariapha seperatela*)
	 *Source: IRRI Rice knowledge bank*

Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Reduced yield of 20 – 100% due to non-management and lack of management of white rice stem borer. The damage by the pest results in reduced plant growth and production of empty grains.
What is it? (TIMP description)	Integrated management of the white stem borer is control of the pest using a combination of cultural, biological and chemical methods. Pest management strategies begin with scouting/monitoring and identification of the pest, then moves to establishment of economic threshold. The practices are as follows: **Cultural methods** • Introduction of high yielding varieties • Pickegg masses from the crop • Grow flowering plants on bunds to serve as food source and shelter site for the natural enemies • Burn stubbles and straws after harvest • Plough deep to kill pupae and larvae in the soil. Drain one or two days when dead heart symptoms is observed in the field • Use light traps to catch stem borer moths (community action may be needed for this activity, otherwise undesirable results may come out • Use potash fertilizers. • Encourage the natural enemies along the bunds. • Avoid use of excessive nirogen fertilization. • Practice uniform planting in an area to reduce concentration of pest in one field • Use of tolerant/resistant cultivar **Biological Control** • *Use f parasitiods Trichogramma spp.* to control rice stem borers. • Use *Bacillus thuringiensis* (BT-based sprays) www.pcpb.go.ke • Use neem based products. www.pcpb.go.ke **Chemical Control** • Spray young plants using recommended insecticides-based products at the manufacturer's recommendation www.pcpb.go.ke. • Avoid using broad-spectrum insecticides early in the season.
Justification	The white stemborer, if not managed, can cause outbreak and total yield loss. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is

	consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products

	• Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	• Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	• Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas. •
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices

	• Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES18500.00
Estimated returns	KES 81500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limited access to knowledge and information on IPM by various gender groups • Where there is disjoint between gender involved in decision making regarding pest management this affects implementation of IPM in management of the pest • Limited access to finances to access the IPM components by men, women and youths involved in rice production • Slow information and awareness flow to female farmers due to academic levels • Limited involvement of youth in rice value chain • The training materials and strategies may not always be favorable to women farmers
Gender related opportunities	• Opportunities exist for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Empower women and youth to acquire production inputs necessary for IPM including improved varieties e.t.c. • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Where there is limited involvement of VMGs in community action, the pest management efforts might be ineffective • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication

	• Involvement of VMGs in community action activities towards rice production and management of pests • Well organized VMG-friendly market access conditions • Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Control of golden apple snails in Mwea irrigation scheme
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank 3. Pest Control Products Board List of registered products (www.pcpb.co.ke)
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 – Ready for upscaling
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	**KALRO, IRRI AfricaRice, NIA, MoALP**

Research Gaps:

- Explore bio-control options for management of rice stem borer
- Explore the efficacy of bio-pesticides and ITKs in pest management at different stages of the stem pest
- Validation of tolerance of new varieties to pests.
- Validate ecological engineering in management of stem borer

2.9.9 Integrated Management of Sotted Rice Stem Borer (*Chilo partellus)*

2.9.9 TIMP Name	**Integrated Management of Spotted Rice Stem Borer (*Chilo partellus)***
	  

Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem to be addressed	Reduced yield of 20% due to spotted stem borer infestation in rice production.
What is it? (TIMP description)	Integrated management of the spotted rice stem borer is a combination of cultural, biological and chemical methods. Effective IPM entails starting from with environmentally friendly (cultural), biological and chemical options. This includes; **Cultural methods** • Plant using high yielding varieties • Hand pick of egg masses form the plants • Conserve natural enemies by growing flowering plants on the bund • Burn infestated stubble and straws after harvesting. • Ploug deep to kill pupae and larvae in the soil. Drain the field one or two days when dead heart symptom is observed in the field • Use light traps to catch stem borer moths • Plant using potash fertilizers and avoid excessive use of nirogen fertilization. • Apply calcium silicate at 1000 kg / ha to strengthen stem tissues • Destroy alternative host plants such as rice ratoon and rice volunteers on bunds • Apply correct amounts of nitrogen in 3 splits at basal, tillering and panicle initiation • Plant tolerant cultivars such as BW 196 SC213, Trenasse. **Biological Control** • *Use of parasitiods Trichogramma spp.* Or *Bacillus thuringiensis* e.g. Baciguard 16 WDG, Bio-T-Plus, Biokill WP to control the pest. • Use neem based products e.g. Nimbecidine, Neemroc 0.03 % and Achook 0.15 % according to the manufacturer recommendation. **Chemical Control** • Spray young plants using recommended insecticides based products at the manufacturer's recommendation www.pcpb.go.ke. • Avoid using broad-spectrum insecticides early in the season.
Justification	The rice spotted stem borer can cause significant yield loss in rice systems. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is

	consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products

	• Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas. •
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.

Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 8500.00
Estimated returns	KES 81500.00 per acre as opposed to
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limited access to knowledge and information on IPM by various gender groups • Where there is disjoint between gender involved in decision making regarding pest management this affects implementation of IPM in management of the pest • Limited access to finances to access the IPM components by men, women and youths involved in rice production • Limited involvement of youth in rice value chain • The training materials and strategies may not always be favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Empower women and youth to acquire production inputs necessary for IPM including improved varieties e.t.c. • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Where there is limited involvement of VMGs in community action, the pest management efforts might be ineffective • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication • Involvement of VMGs in community action activities towards rice production and management of pests • Well organized VMG-friendly market access conditions

	• Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• none
Application guidelines for users	• http://www.knowledgebank.irri.org/ • CABI Plantwise Plus Knowledge Bank • Pest Control Products Board List of registered products (www.pcpb.co.ke)
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 - Ready for upscaling
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	KALRO, IRRI AfricaRice, NIA, MoALP

Gaps:

- Explore bio-control options for management of rice stem borer
- Explore the efficacy of bio-pesticides and ITKs in pest management at different stages of the stem pest
- Validation of tolerance of new varieties to pests.
- Validate ecological engineering in management of stem borer,

2.9.10 Integrated Management Rice Gall Midge Orseolia oryzae (*Wood mason*)

2.9.10TIMP Name	**Integrated management rice gall midge Orseolia oryzae**
	 Adult midge on a leaf (IRRI Knowledge Bank)  (2) Rice gall midge larvae on leaves (IRRI Knowledge Bank)  (3) Onion shaped Galls on rice shoot (IRRI Knowledge Bank)
Category (i.e. technology, innovation or management practice)	Management practice

A: Description of the technology, innovation or management practice	
Problem to be addressed	Reduced rice production by 30-40% due to lack of control/management of the pest in both irrigated or rainfed wetland environments, with highest infestation being during the tillering stage of the rice crop.
What is it? (TIMP description)	Integrated management of the rice gall midge is the use of various control strategies such as cultural, biological and chemical control to manage the pest. These are; **Cultural Practices** • Destroy alternative host plants and rice stubble after harvest • Plant early maturing varieties and synchronized planting in the area Plant tolerant rice varieties such Nerica 1 and Nerica 2 • Handpick and destroy egg masses at seedbed • Don't transplant infested plants • Avoid use of excessive nirogen fertilization • Uniform planting of rice in one area **Biological Control** • *Use parasitiods wasp Aprostocetus procerae* and *Platygaster diplosisae* to control rice gall midges. • *Bacillus thuringiensis* (BT based sprays) • Use neem based products. • Use recommended pesticides www.pcpb.go.ke **Chemical Control** • Spray young plants using recommended insecticides based products at the manufacturer's recommendation www.pcpb.go.ke. • Avoid using broad-spectrum insecticides early in the season, although insecticides are unlikely to be effective in control of the pest.
Justification	The pest infestation results in onion-like or silver shoots and the death of young tillers, which in turn stimulates production of more tillers, hence stunting and bushiness resulting in increased population of the pest. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-

	pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay

Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health

	• Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time. •
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	• KES.18500.00
Estimated returns	• KES.81500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limited access to knowledge and information on identification of pests, symptoms and use IPM by various gender groups • Where there is disjoint between gender involved in decision making regarding pest management this affects implementation of IPM in management of the pest • Limited access to finances to access the IPM components by men, women and youths involved in rice production • Limited involvement of youth in rice value chain • The training materials and strategies may not always be favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Empower women and youth to acquire production inputs necessary for IPM including improved varieties e.t.c. • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups involving all gender groups on use of IPM in pest management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Increased production due to adoption of high tillering varieties may increase pest population and without sufficient knowledge this affects productivity among VMGs if managmenet of pest is not done on time • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM by VMGs • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication • Involvement of VMGs in community action activities towards rice production and management of pests • Well organized VMG-friendly market access conditions

	• Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• none
Application guidelines for users	• http://www.knowledgebank.irri.org/ • CABI Plantwise Plus Knowledge BankPest Control Products Board List of registered products (www.pcpb.co.ke)
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	2 - Requires validation.
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	**KALRO, IRRI AfricaRice, NIA, MoALP**

Gaps:

- Explore bio-control options for management of rice gall midge
- Explore the efficacy of bio-pesticides and ITKs in pest management at different stages of the rice gall midge
- Validation of tolerance of new varieties to the pest

2.9.11 Integrated management of Rice Stalk-Eyed Shoot fly (*Diopsis thoracica*)

2.9.11 TIMP Name	**Integrated management of Rice Stalk Eyed Shoot fly *Diopsis thoracica***
	Source: CABI Plantwise knowledge bank 
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	

Problem to be addressed	Yield losses of up to 97% caused by the rice stalk eyed fly especially on young seedlings of rice.
What is it? (TIMP description)	Integrated pest management strategies for the control of stalk eyed fly is a combination of cultural practices, biopesticides, biological control and synthetic chemicals. **Cultural** pratcies; • field sanitation • Clipping the tip of the seedlings prior to transplantation to eliminate egg masses • Trapping of adults flies • Use of pheromone lures and planting early maturing and/or short varieties **Biological control:** • Conservation of natural enemies **Chemical** control: • In nursery , Spray with systemic insecticides • Seedlings root dip treatment for 12 or 14 hours before transplanting in in recommended insecticide (PCPB (www.pcpb.go.ke)
Justification	The stalk-eyed shoot fly is a pest of economic importance as it attacks the plants resulting in significant yield loss if not controlled. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print

	• Publications -posters/brochures/leaflets, manuals •
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers

	• Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas. •
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 18500.00
Estimated returns	KES 81500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limited access to knowledge and information on IPM by various gender groups • Where there is disjoint between gender involved in decision making regarding pest management this affects implementation of IPM in management of the pest

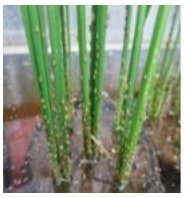
	• Limited access to finances to access the IPM components by men, women and youths involved in rice production • Limited involvement of youth in rice value chain • The training materials and strategies may not always be favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Empower women and youth to acquire production inputs necessary for IPM including improved varieties e.t.c. • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management
VMG issues and concerns in development, dissemination, adoption and scaling up	• Where there is limited involvement of VMGs in community action, the pest management efforts might be ineffective • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication • Involvement of VMGs in community action activities towards rice production and management of pests • Well organized VMG-friendly market access conditions • Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• MRGM rice growing
Application guidelines for users	• http://www.knowledgebank.irri.org/ • CABI Plantwise Plus Knowledge Bank • Pest Control Products Board List of registered products (www.pcpb.co.ke)
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 – Ready for upscaling
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea

	P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L
Partner organizations	KALRO, IRRI AfricaRice, NIA, MoALP

Gaps:

- Biological control of the rice stalk eyed fly.
- Use of ITK in management of the pest**.**

2.9.12 Integrated Management of Rice Aster Leafhopper (*Macrosteles fascifrons*)

2.9.12 TIMP Name	**Integrated Management of Rice Aster Leafhopper (*Macrosteles fascifrons*)**
	 A Adult hopper on rice tiller  B A. Pale green adults with black markings feed on rice tiller  C Rice leaf hoppers attacking rice tillers *Source: CABI Plantwise Knowledge bank*
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem to be addressed	Reduced yield of rice due to infestation by the pest
What is it? (TIMP description)	Integrating pest management strategies for the control of rice Aster leafhoppers include cultural practices, biopesticides, biological control and synthetic chemicals. **Cultural practises** • Scout the fields twice weekly bylooking under the leaves • Plough deep to expose pupae to sunlight and predatory birds • Maintain clean bunds and plant flowering crop plants to attract the natural enemies. **Biological management:** • Spray using neem formulation(www.pcpb.go.ke). • Spray using the plant using bacteria and fungal biopesticides (*Bacillus thuringiensis* v. kurstaki formulations or *Metarhizium anisopliae* or *Beauveria bassiana*) www.pcpb.go.ke

	• Repeat the spray based on weekly scouting at >10% fresh infestation. **Chemical management** • Spray using recommended insecticides (www.pcpb.go.ke).
Justification	The adult hoppers feed on rice plants causing stunting deformation and reduced yield. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.

Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.

Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 18500.00
Estimated returns	KES 81500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth • Land ownership mainly by men who have interest in rice • Financial empowerment, the farmers have acess to finances from cooperative societies and commercial banks and to acquire inputs • Limited involvement of youth in rice value chain
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Empower women and youth to acquire production inputs necessary for IPM including improved varieties e.t.c. • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in pest and disease management

VMG issues and concerns in development, dissemination, adoption and scaling up	• Where there is limited involvement of VMGs in community action, the pest management efforts might be ineffective • Dissemination methods and documents that are not always easy to understand or access • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Availability, accessibility and affordability of IPM strategies for rice cultivation • Make VMG-friendly training materials with illustrations to enhance communication • Involvement of VMGs in community action activities towards rice production and management of pests • Well organized VMG-friendly market access conditions • Integrated management of the pest reduces production costs therefore VMG's can afford to produce safe and quality rice, and safety of VMG's is taken into account • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank 3. Pest Control Products Board List of registered products (www.pcpb.co.ke)
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 – Ready upscaling
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	KALRO, IRRI AfricaRice, NIA, MoALP

Gaps:

- Search for biological control agents and or enhance the development of indigenous natural enemies.
- The use ITK on management of the pest.

2.9.13 Integrated Management of Red Billed Quelea, Quelea quelea migratory birds

2.8.14 TIMP Name	**Integrated Management of Red billed quelea, Quelea quelea migratory birds**
	   *Clockwise from top: (a) Red billed quelea, Quelea quelea; (b) Empty rice grain panicles; (c) bird scaring*
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Reduced yeild of 60-100% caused by the Red billed quelea, Quelea quelea birds in most rice fields,
What is it? (TIMP description)	Integrating pest management strategies for the control of migratory birds involves a combination of cultural practices and biopesticides, biological control and synthetic chemicals. These includes: **Cultural practices:** • Use of human scarers, scarecrows and other scaring devices • Use of different kinds of nets to deter the birds • Plant early trap crops near trees and power lines to minimize bird damage to rice • The Red-billed Quelea is a notifiable pest and farmers should report its presence in their frams to the Ministry of Agriculture staff who will make arrangements to manage it • Use IRRI-Tape Bird Deterrent which has a reptilian sheen that scares away birds. **Chemical management** • Only authorised pesticids by DLCO is recommended for use in the management of migratory birds.
Justification	The migratory birds cause reduced yield in rice of up to 100%. They feed on small grains and migrate long distances to many areas with rice. An integrated pest management of the birds uses cultural, biological and chemical pesticicdes based on the level of damage. This management practices encourages the build up of natural enemies, uses options that are not harmful to the environment and improves food safety and sustainable pesft management **.**

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.

Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas. •
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption

	• Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 30,000.00
Estimated returns	KES70,000.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in bird scaring, which is mostly done by women, children and youth • Opportunity cost of bird-scaring resulting in losses • Alternative bird scaring methods are costly for women and youth
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Women and youth friendly financing options to enable access to alternative large- and small-scale bird scaring techniques
VMG issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in bird scaring, which can lead to huge loss of production by the VMGs if not effectively done • Opportunity cost of bird-scaring resulting in losses • Alternative bird scaring methods are costly for VMGs
VMG related opportunities	• Opportunities for VMGs employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • VMG-friendly financing options to enable access to alternative large- and small-scale bird scaring techniques
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Use hawk-like kite to scare birds
Application guidelines for users	1. Kega *et al* 2015. Rice production manual 2. Musila *et at* 2021 Rice production handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2- requires validation; 3-requires further research**)**	2 – Requires validation
G. Contacts	
Contacts	The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	Bernard M Ngari, Ruth Musila, Miriam Otipa, Simon Njinju
Partner organizations	**KALRO, IRRI AfricaRice, NIA, MoALP**

Research Gaps:

- Eplore cultural control options for management of birds

- Explore the efficacy of ITKs in pest management at different stages of the birds
- Validation of tolerance of new varieties to the pest

2.9.14 Integrated Management of Rodents in rice fields

2.8.15 TIMP Name	**Integrated Management of Rodents in rice fields**
	   *Orianthi's niloticus* (Biolib.cz) (2) Striped grass mouse *Lemniscomys striatus* (wikipedia.org) (3) Stri *e* (w
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	The damage by Rodents can reduce rice yield up to 100% .especially at planting and germinating stages.
What is it? (TIMP description)	Integrating pest management strategies for the control of rodents is a combination of cultural practices, and use of biopesticides, biological control products and synthetic chemicals. IPM management strategies begins with scouting/ monitoring of the pest, identification, establishment of economic threshold levels and finally application of any of the following control measures **Cultural practices** • Use traps and decoy baits, and erect water barriers around the rice fields. • Clear bushy bands around the rice paddies • Ensure paddies are weed free to eliminate rodents • Store the rice in rat proof storage facilities **Biological management** • Use predators, e.g. cats, to eliminate rodents **Chemical management** • Use recommended baits (www.pcpb.go.ke)
Justification	Integrated Management of rodents involves the use of a combination of cultural and biocontrol methods that are relatively safe. Currently rice farmers use a lot of synthetic pesticides in the control of this pest

	and this may not be safe to human consumption. Integrated pest management should be promoted in rice production considering that the crop is consumed very widely in Kenya. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
• Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton

	• PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices

	• Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time. •
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 9000.00
Estimated returns	KES 9100.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Management of rodents may involve use of pesticides that may be particularly harmful to men, youth and women • Limited knowledge on how to safely manage the rodents to minimize food and environment contamination
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reach more women groups with information on management of rodents • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of rodents
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious rodent management practices • Dissemination approaches that are not always easy to understand or access • Safety of VMGs when handling the chemical control options under the integrated approach
VMG related opportunities	• Develop friendly training approaches and materials with illustrations to enhance communication • Well organized friendly trading conditions • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 - Ready for upscaling

G. Contacts	
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Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Farmers, Extension Agents (Public and Private), research organizations and universities, companies producing bio-pesticide / biological products as well as CGIAR's, traders, millers, seed dealers, researchers

Gaps:

- Explore cultural control options for management of rodents
- Explore the efficacy of ITKs in pest management at different stages of the rodents
- Validation of tolerance of new varieties to the pest

2.9.15 Integrated Management of Larger Grain Borer *Prostephanus trucantus* in rice storage

2.9.15 TIMP Name	**Integrated Management of Larger Grain Borer *Prostephanus trucantus* in rice storage**
	 Larger Grain Borer (*Source: Infonet Biovision*)
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	The larger grain borer causes losses of up to 100 percent in storage
What is it? (TIMP description)	An integrate management approach for control of the larger grain borer. It includes the use cultural practices, biological control products and synthetic chemicals based on the economic threshold levels. IPM management strategies begins with scouting/ monitoring of the pest, identification, establishment of economic threshold levels and finally application of any of the following control measures. **Cultural practices**

	• Good store hygiene - cleaning stores before harvesting by removing and burning infested residues. Before storing, sort rice grain and remove those with visible pest damage. • Dry grains well before storage and use metal silos and/or hermetic bag for storage • Use repellent plant materials (e.g. 5–10% of neem leaf powder) to preserve the grain • Use pheromone traps to attract LGB **Biological management** • Use of a predatory beetle (*Teretrius nigrescens*) at rate of 10/m^2 to control LGB **Chemical management** • Spray the store surfaces before use by applying Pirimifosmethyl (Actellic 25 EC – 200ml/10lts water). • Dust rice grains using Actellic 1 % at the rate of 50gm/90kg bag; Spinsad (spintor dust – 50g/ 90Kg) (www.pcpb.go.ke)
Justification	The Large Grain Borer is found in rice growing areas and caused yield lose ranging from 10-100%. Rice is a major food crop in Kenya and therefore an integrated management approach of the LGB that ensures that farmers and large scale producers can safely store their food and harvest while identifying most suitable markets. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management

	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand

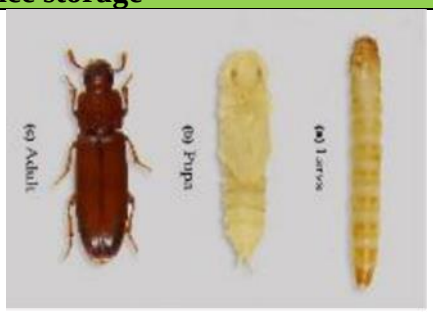
	• Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 9000.00
Estimated returns	KES 91000.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Management of LGB may involve use of pesticides that may be particularly harmful to men, youth and women • Limited knowledge on how to safely manage the LGB to minimize food contamination due pesticide residues. • Fewer opportunities for training to youth and women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reaching more women groups with information on management of LGB • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of LGB
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious LGB management practices • Dissemination approaches that are not always easy to understand or implement • Safety concerns for VMGs when handling the chemical control options under the integrated approach
VMG related opportunities	• Develop friendly training approaches and materials with illustrations to enhance communication • Well organized friendly trading conditions • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Use of hematic bags for storage of dry grain after harvesting
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	Requires validation
G. Contacts	
Contacts	The Centre Director, ICRIC Mwea P.O. Box 298, Kerugoya Email:kalro.mwea@kalro.org Phone: 0202028217
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Farmers, Extension Agents (Public and Private), research organizations and universities, companies producing bio-

	pesticide/biological products as well as CGIAR's, traders, millers, seed dealers, researchers

Research Gaps:

- Explore cultural control options for management of LGB.

2.9.16 Integrated Management of Red Flour Beetles (*Tribolium castaneum*) in rice storage

2.9.16 TIMPs Name	**Integrated Management of Red Flour Beetles (*Tribolium castaneum*) in rice storage**
	 Adult pupae larvae
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	The red flour beetles causes storage losses up to 30-80% in storage rice.
What is it? (TIMP description)	An integrated pest management approach for management of the larger grain borer includes the use cultural practices, biological control products and synthetic chemicals. IPM management strategies begins with scouting/ monitoring of the pest, identification, establishment of economic threshold levels and finally application of any of the following control measures. **Cultural practices:** • Good store hygiene - cleaning the store before harvesting, removing and burning infested residues; • Sorting the rice grains to remove those with visible pest damage before storage • Place all grains in a sealed plastic bag or an air-tight plastic container with a tight lid. Use of hematic bags is recommended • Regularly inspect stored grain and dry grains well before storage **Biological management:** • Use repellent plant materials such as 5–10% of neem leaf powder to repel the red flour beetles **Chemical management :** • Spray the store surface using Pirimifosmethyl (Actellic25EC–200ml/10lts water); • Dust rice grains using Actellic 1 % at the rate of 50gm/90kg bag: or Spinsad (Spintor dust – 50g/ 90Kg) (www.pcpb.go.ke)

Justification	The red flour beetle is found in rice growing areas. The adult beetle causes up to 100% damage of rice grains. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/ companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level

	• KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	• Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	• Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices

	• Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 9000.00
Estimated returns	KES 91,000.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Management of red flour beetle may involve use of pesticides that may be particularly harmful to men, youth and women • Limited knowledge on how to safely manage the red flour beetle to minimize food contamination due pesticide residues. • Fewer opportunities for training to youth and women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reaching more women groups with information on management of red flour beetle • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of red flour beetle
VMG issues and concerns in development, dissemination, adoption and scaling up	• Dissemination approaches that are not always easy to understand or implement • Safety concerns for VMGs when handling the chemical control options under the integrated approach
VMG related opportunities	• Develop friendly training approaches and materials with illustrations to enhance communication • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Use of hematic bags for storage of dry grain after harvesting
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	Requires validation
G. Contacts	
Contacts	The Centre Director, ICRIC Mwea P.O. Box 298, Kerugoya Email:kalro.mwea@kalro.org

	Phone: 0202028217
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Farmers, Extension Agents (Public and Private), research organizations and universities, companies producing bio-pesticide / biological products as well as CGIAR's, traders, millers, seed dealers, researchers

Gaps:

- Explore cultural control options for management of red flour beetle
- Explore the efficacy of ITKs in pest management at different stages of the red flour beetles

2.9.17 Integrated management of Angoumois Grain Moth Sitotroga cerealella in rice storage

2.9.17 TIMP Name	**Integrated management of Angoumois Grain Moth Sitotroga cerealella in rice storage**
	 Angoumois grain moth
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	The Angoumois grain moth causes 10-100% yield loss if not controlled.
What is it? (TIMP description)	An integrate management approach for control of the Angoumois grain moth includes the use cultural practices, biological control products and synthetic chemicals. IPM management strategies begins with scouting/ monitoring of the pest, identification, establishment of economic threshold levels and finally application of any of the following control measures. **Cultural practices** • Seal the stores with insect proof guaze to prevent early infestation. • Separate new and old grain hermetic bags • Do not leave rice grains in the field after drying • Remove infected grains • Use plant extract such as neem, pyrethroid and caster seed as repellant **Biological management**

	• Use repellent plant materials such as 5–10% of neem leaf powder to repel the moths **Chemical management** • Spray the store surfaces before use by applying Pirimifosmethyl (Actellic 25 EC – 200ml/10lts water) • Dust rice grains using Actellic 1 % at the rate of 50gm/90kg bag; Spinsad (spintor dust – 50g/ 90Kg) (www.pcpb.go.ke)
Justification	The Angoumois grain moth causes 10-100% damage of rice grains if not controlled. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/ companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.

Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	• Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	• Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas. •
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.

Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES9,000.00
Estimated returns	KES91,000.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Management of the grain moth may involve use of pesticides that may be particularly harmful to men, youth and women • Limited knowledge on how to safely manage the Angoumois grain moth to minimize food contamination due pesticide residues. • Fewer opportunities for training to youth and women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reaching more women groups with information on management of Angoumois grain mot • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of Angoumois grain moth
VMG issues and concerns in development, dissemination, adoption and scaling up	• Dissemination approaches that are not always easy to understand or implement • Safety concerns for VMGs when handling the chemical control options under the integrated approach
VMG related opportunities	• Develop friendly training approaches and materials with illustrations to enhance communication • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services

E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	Ready for upscaling
G. Contacts	
Contacts	The Centre Director, ICRIC Mwea P.O. Box 298, Kerugoya Email:kalro.mwea@kalro.org Tel No: +254 0202028217
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, Companies producing bio-pesticide / biological products as well as CGIAR's, Traders, Millers, Seed dealers, Researchers

Gaps:

- Explore cultural control options for management of Angoumois grain moth storage pest.
- Explore the efficacy of ITKs in pest management at different stages of the storage pests
- Search for predators and parasitoids of storage pests.

2.9.18 Integrated Management of Granivourous birds

2.9.18 TIMP Name	Integrated management of Granivourous birds
	 Granivorous birds  Empty grain panicles
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Productivity loss due to birds feeding on the grains. The birds reduces yield by 10-100% depending on the population granivorous birds.

What is it? (TIMP description)	Integrated management of the graivourous birds includes the use of various pest control strategies such as cultural, biological and chemical control. To effectively manage the insect damage on the crop, start from the environmentally friendly (cultural) strategy and move towards chemical control methods. IPM management strategies begins with scouting/monitoring of the pest, identification, establishment of economic threshold levels and finally application of any of the following control measures; **Cultural practices** • Use, human scarers, scarecrows and scaring devices to keep birds off the rice crop • Use different kinds of nets to cover rice to deter the birds • Plant early trap crops near trees and power lines to minimize bird damage to rice • Chilli extracts as a repellent – applied every two weeks at one litre per hectare • Use IRRI-Tape Bird Deterrent tape that has a reptilian sheen that scares away birds • Use kite with a hawk design. **Biological management** • None is availiable **Chemical management** • Not recommended
Justification	Integrated Management of granivorous birds considers food safety and environmental safety and it involves the use of a combination of cultural and biocontrol methods and biopesticides that are relatively safe. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models

	• Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/ companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	• Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	• Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers

	• Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/ companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 30,000.00
Estimated returns	KES 70,000.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in bird scaring, which is mostly done by women, children and youth • Opportunity cost of bird-scaring resulting in losses • Alternative bird scaring methods are costly for women and youth
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations.

	• Women and youth friendly financing options to enable access to alternative large- and small-scale bird scaring techniques
VMG issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in bird scaring, which can lead to huge loss of production by the VMGs if not effectively done • Opportunity cost of bird-scaring resulting in losses • Alternative bird scaring methods are costly for VMGs
VMG related opportunities	• Opportunities for VMGs employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • VMG-friendly financing options to enable access to alternative large- and small-scale bird scaring techniques
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Use hawk like kite to scare birds
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	2 – Requires validation
G. Contacts	
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Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	KALRO, IRRI AfricaRice, NIA, MoALP

Gaps:

- Explore cultural control options for management of granivorous birds
- Explore the efficacy of ITKs in pest management at different stages of the granivorous birds
- Validation of tolerance of new varieties to the pest

2.9.19 Integrated Management of rice Weevil (*Sitophilus oryzae)* in rice storage

2.9.19 TIMP Name	**Integrated management of rice weevil *Sitophilus oryzae* in rice storage**
	
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	

Problem to be addressed	The rice weevil causes 10-100% yield loss if not controlled.
What is it? (TIMP description)	An integrated pest management approach for control of the rice weevil. It includes the use cultural practices, biological control products and synthetic chemicals. IPM management strategies begins with scouting/ monitoring of the pest, identification, establishment of economic threshold levels and finally application of any of the following control measures **Cultural practices:** • Good store hygiene - cleaning the store before harvesting, removing and burning infested residues; • Sorting the rice grains to remove those with visible pest damage before storage • Place all grains in a sealed plastic bag or an air-tight plastic container with a tight lid. Use of hematic bags is recommended • Regularly inspect stored grain and dry grains well before storage **Biological management:** • Use repellent plant materials such as 5–10% of neem leaf powder to repel the red flour beetles **Chemical management:** • Dust rice grains using with recommended insecticides (www.pcpb.go.ke) • Fumigate the stores using the recommend pesticide (www.pcpb.go.ke).
Justification	The rice weevil causes 10-100% damage of rice grains if not controlled. They are very destructive and if not controlled in time they completely destroy the rice grains. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay

Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.

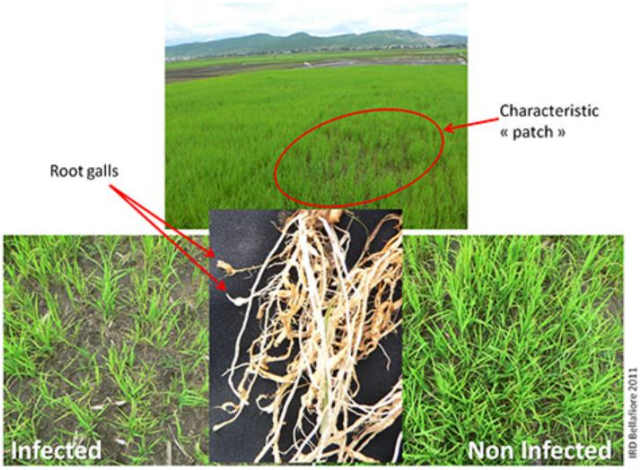
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 9000.00
Estimated returns	KES 91,000.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Management of rice weevil may involve use of pesticides that may be particularly harmful to men, youth and women • Limited knowledge by various gender groups on how to safely manage the rice weevil to minimize food contamination due pesticide residues. • Fewer opportunities for training to youth and women farmers • The training materials and strategies may not always be favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reaching more women groups with information on management of rice weevil • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of rice weevil
VMG issues and concerns in development, dissemination, adoption and scaling up	• Where there is limited involvement of VMGs in community action, the pest management efforts might be ineffective • Dissemination approaches that are not always easy to understand or implement • Safety concerns for VMGs when handling the chemical control options under the integrated approach • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Involvement of VMGs in community action activities towards rice production and management of pests • Develop friendly training approaches and materials with illustrations to enhance communication • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services • Well organized VMG-friendly market access conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Use of hematic bags for storage of dry grain after harvesting
Application guidelines for users	1. Kega *et al.,* 2015. Rice production manual 2. Musila *et al.,* 2021 Rice production handbook
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling

G. Contacts	
Contacts	The Centre Director, ICRIC Mwea P.O. Box 298, Kerugoya Email:kalro.mwea@kalro.org Tel No.: +254 0202028217
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J.
Partner organizations	Farmers, extension agents (public and private), research organizations and universities, companies producing bio-pesticide / biological products as well as CGIAR's, traders, millers, seed dealers, researchers

Gaps:

- Explore cultural control options for management of storage pests
- Explore the efficacy of ITKs in pest management at different stages of the storage pests
- Search for predators and parasitoids of storage pests

2.9.20 Integrated Management of rice Nematodes in rice fields

2.9.20 TIMP Name	Integrated management of rice nematodes in rice fields
	
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Rice nematodes infest rice nurseries, rainfed upland rice and lowland rice causing losses from 28 - 87%.
What is it? (TIMP description)	An integrated pest management approach for control of nematodes. It includes the use cultural practices, biological control products and synthetic chemicals. IPM management strategies begins with monitoring of the pest, identification, establishment of economic threshold levels and finally application of any of the following control measures.

	Cultural practice • Use of resistant rice varieties • Fallowing, crop rotation, and soil solarization to reduce existing infestations • Minimize damage by adjusting planting dates to cooler times of the season when nematodes are less active. • Use nematode-free plants purchased from certified seed suppliers. • Intercrop with marigolds (*Tagetes* species), suppress root knot and lesion nematodes **Chemical management** **Biological Control** • Drenching with Azadirachtin (Neemark, Nemros, Achook), Nimbecidine • Use of Beauvitech WP (Beauveria bassiana) or Bio-Power (Beauveria bassiana), or Botanigard (Azadirachtin). **Chemical Control:** • Use of Abamectin or Abamectin + Fosthiazate and Dazomet based products around the root zone of the plant. • Seeds can be treated with non-fumigant nematicides to reduce the number of nematodes before planting (www.pcpb.go.ke).
Justification	The rice nematodes causes yield loss in upland and lowland if not controlled. They cause damage in nurseries and field and resulting malformations that distort plant growth and consequently yield. Currently rice farmers use a lot of synthetic pesticides in the control of this disease and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies

	• A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides

	• Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 15500.00
Estimated returns	KES 84500.00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limited knowledge by various gender groups on how to safely manage the nematodes to minimize due pesticide residues and environment contamination. • Limited access to knowledge on IPM by VMGs • Low access to input (for IPM components) and output (for quality produce) markets • Fewer opportunities for training to youth and women farmers • The training materials and strategies may not always be favorable to women farmers • Financial constraints limiting access to information and inputs
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reaching more women groups with information on management of nematodes

	• Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of nematodes
VMG issues and concerns in development, dissemination, adoption and scaling up	• Where there is limited involvement of VMGs in community action, the pest management efforts might be ineffective • Dissemination approaches that are not always easy to understand or implement • Safety concerns for VMGs when handling the chemical control options under the integrated approach • Limited access to knowledge on IPM • Low access to input (for IPM components) and output (for quality produce) markets • Financial constraints limiting access to information and inputs
VMG related opportunities	• Involvement of VMGs in community action activities towards rice production and management of pests • Develop friendly training approaches and materials with illustrations to enhance communication • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services • Well organized VMG-friendly market access conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• None
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 - Ready for upscaling
G. Contacts	
Contacts	The Centre Director, ICRIC Mwea P.O. Box 298, Kerugoya Email:kalro.mwea@kalro.org Tel No.: +254 0202028217
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, Companies producing bio-pesticide / biological products as well as CGIAR's, Traders, Millers, Seed dealers, Researchers

Gaps:

- Explore cultural control options for management of rice nematodes
- Explore the efficacy of ITKs in pest management at different stages of the rice nematodes
- Search for entomo-pathogenic nematodes for control

2.9.21 Integrated Mmanagement of Golden Apple Snails and Slugs in rice

2.9.21 TIMPs name	Integrated Management of Golden Apple Snails and Slugs in rice
	 Source: IRRI Rice Knowledge bank
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	The golden apple snails feeds on young rice seedling causing 30-100% damage. It is an invasive pest that causes up to 100% loss if uncontrolled.
What is it? (TIM P description)	Integrating pest management strategies for the control of golden apple snails and slugs. It includes the use cultural practices, biological control products and synthetic chemicals. IPM management strategies begin with scouting/ monitoring of the pest, identification, establishment of economic threshold levels and finally application of any of the following control measures. **Cultural control** • Hand pick snails, slugs and eggs and crush them • Place barriers where water enters and exit the field and clean the canals frequently • Only transplant seedling that are over 21 days old • Deep ploughing and levelling of the fields • Drain the water a day before transplanting, and the Irrigate 3 days after transplanting • Use plant attractants and botanicals extracts such Neem • Use resistant rice varieties • Alternate wetting and drying • Levelling the field and fallowing are also recommending along the banding as well as digging furrows at the end of the farm so that the water in the furrows trap the apple snails **Biological control** • Use predators to feed on the snails such as wild ducks. **Chemical control** • Use of commercial molluscicide(tea saponin) biopesticide BIOGRADE **(**www.pcpb.go.ke**)**
Justification	Golden apple snails is invasive and attack rice at seedling stage. It can cause destroy young rice causing a heavy losses to rice farmers and can lead to 100% damage. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should

	be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products

	• Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted, if any	• Kirinyaga. The county government provided the rice farmers with BIOGRADE to control golden apple snail.
Counties where TIMP will be upscaled	• Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Recommendations for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/ companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling, if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.

Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 24,000.00
Estimated returns	KES 76,000,00
Gender issues and concerns in development, dissemination, adoption and scaling up	• Management of Golden Apple snails and slugs may involve use of pesticides that may be particularly harmful to men, youth and women • Limited knowledge on how to safely manage the snails and slugs to minimize food contamination due pesticide residues. • Fewer opportunities for training to youth and women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reaching more women groups with information on management of snails and slugs • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of snails and slugs
VMG issues and concerns in development, dissemination, adoption and scaling up	• Dissemination approaches that are not always easy to understand or implement • Safety concerns for VMGs when handling the chemical control options under the integrated approach
VMG related opportunities	• Develop friendly training approaches and materials with illustrations to enhance communication • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, ICRIC Mwea P.O. Box 298, Kerugoya Email:kalro.mwea@kalro.org

	Tel No.: +254 0202028217
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, Companies producing bio-pesticide / biological products as well as CGIAR's, Traders, Millers, Seed dealers, Researchers

Gaps:

- Explore cultural control options for management of golden apple snails and slugs
- Explore the efficacy of ITKs in pest management at different stages of the pests
- Search for predators and parasitoids of snails and slugs
- Explore the use Golden Apple snail as food for humans and livestock feed.

2.9.22 Integrated Pest Management of Fall Army Worm in rice fields

2.9.22 TIMPs name	**Integrated Pest Management of Fall Army Worm in rice fields**
	
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Fall armyworm (FAW) can reduce the yield of rice by up to 100% if not controlled.
What is it? (TIMP description)	Integrating pest management strategies for the control of FAW include cultural practices, biopesticides, biological control and synthetic chemicals. These are; **Cultural practices** • Scout the fields twice weekly, looking for dead or wilting plants • Use pheromone traps to detect the adult moths and take timely action to reduce egg laying and larval development. White and yellow traps are more effective than green trap • Use bait traps to detect the distribution of the larvae hiding in the soil before the seedlings emerge. • Use non-host cover crops to y improve the general soil health status of the soil and help reduce pest, disease and weed pressure while an area of land is not in cropping season • Control weeds • Destroy infected crop residues after harvest by burning to reduce pests.

	Biological management • Spray using neem formulations (Azadiractin, 1500 ppm) @ 5 ml /I or one litre / acre or 5 %, Neem seed kernal extract (NSKE) immediately after observation of one moth/ trap/ day or 10 % plant infestation at early booting stage • Spray using *Bacillus thuringiensis* v. kurstaki formulations 2 % @2 g / l or *Metarhizium anisopliae* or *Beauveria bassiana* @ 5 g/ litter at 5-10 % infestation. Repeat the spray based on weekly scouting at >10 % fresh infestation. **Chemical management** • Spray using Flubendamide (belt at 5 ml / 20 L, Chlorothraniliprole (Voliam targo at 20 ml / 20 L), Thiamethoxam and lambdacyhalothrin (Engeo (20 ml / 20 L), • Spray with Spinetoram (Radiant at 20 mls/20 L water), Lufenuron (MATCH at 25 ml / 20 L)
Justification	The FAW infestation cause yield loses of up to 47% in rice in Kenya**.** The infestation by this pest compromises the quality of the crop. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated pest management should be highly advocated in rice considering that the crop is consumed very widely in Kenya than maize. This involves the use of a combination of cultural and bio-control and biopesticides that are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals •
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/ companies producing biologicals and biopesticides and farmers to enhance promotion.

	• A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their role	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted, if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be upscaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Recommendations for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas

	• Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling, if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 15500.00
Estimated returns	KES 84500.00
Gender issues and concerns in development ,dissemination, adoption and scaling up	• Management of FAW may involve use of pesticides that may be particularly harmful to men, youth and women • Limited knowledge on how to safely manage the red flour beetle to minimize food contamination due pesticide residues. • Fewer opportunities for training to youth and women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reaching more women groups with information on management of FAW • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of FAW
VMG issues and concerns in development, dissemination, adoption and scaling up	• Dissemination approaches that are not always easy to understand or implement • Safety concerns for VMGs when handling the chemical control options under the integrated approach

VMG related opportunities	• Develop friendly training approaches and materials with illustrations to enhance communication • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires	1 - Ready for upscaling
further research**)**	
G: Contacts	
Contacts	The Centre Director, ICRIC Mwea P.O. Box 298, Kerugoya Email:kalro.mwea@kalro.org Tel No.: +254 0202028217
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L
Partner organizations	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, Companies producing bio-pesticide / biological products as well as CGIAR's, Traders, Millers, Seed dealers, Researchers

2.9.23 Integrated Management of soil pests Cut worms for upland rice (*Agrotis spp*)

2.9.23 TIMPs name	**Integrated Management of soil pests Cut worms for upland rice (*Agrotis* spp)**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Cut worm damage reduces the yield of rice crop by up to 47%.
What is it? (TIMP description)	Integrating pest management strategies for the control of cut worms including cultural practices, biopesticides, biological control and synthetic chemicals. **Cultural practices** • Scout the fields twice weekly, looking under the leaves and panicles • Use pheromone trap sto detect the adult moth flights and take timely action to reduce egg laying and larval development. White and yellow traps • Bait traps can detect the distribution of the larvae hiding in the soil – before the seedlings emerge.

	• Weed control: Young weeds can be an important food source for cutworms • Destroy crop residues after harvest to reduce further generations form continued egg-laying **Biological management** • Foliar applied bio-pesticides e.g. entomo-pathogenic fungi and bacteria is used in the management to target adult moths and eggs. • Spray using *Bacillus thuringiensis* v. *kurstaki formulations* 2 % @2 g / l or *Metarhizium anisopliae* or *Beauveria bassiana* @ 5 g / litter at 5-10 % infestation. Repeat the spray based on weekly scouting at >10 % fresh infestation. **Chemical management** • Application of systemic neonicotinoids to seeds can provide some protection to seeds and seedlings. • Spray with *lambda-cyhalothrin*
Justification	The cutworm infestation causes yield loses of up to 47% in rice in Kenya. The infestation by this pest also compromises its quality of the crop. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion.

	• A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted, if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be upscaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Recommendations for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas

	• Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling, if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES18500.00
Estimated returns	KES81500.00
Gender issues and concerns in development ,dissemination, adoption and scaling up	• Management of cutworms may involve use of pesticides that may be particularly harmful to men, youth and women • Limited knowledge on how to safely manage the cutworms to minimize food contamination due pesticide residues. • Fewer opportunities for training to youth and women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reaching more women groups with information on management of pest • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of the pest beetle
VMG issues and concerns in development, dissemination, adoption and scaling up	• Dissemination approaches that are not always easy to understand or implement • Safety concerns for VMGs when handling the chemical control options under the integrated approach

VMG related opportunities	• Develop friendly training approaches and materials with illustrations to enhance communication • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires	Ready for upscaling
further research**)**	
G: Contacts	
Contacts	The Centre Director, ICRIC Mwea P.O. Box 298, Kerugoya Email:kalro.mwea@kalro.org Tel No.: +254 0202028217
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L
Partner organizations	

2.9.24 Integrated management of Leaf Mining Beetles (*Trichispa sericea*)

2.9.24 TIMPs name	**Integrated management of leaf mining beetles (*Trichispa sericea*)**
	 
	Trichispa sericea Source: Infonet Source: Plantwise Knowledge Bank
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Leaf mining beetles *(Trichispa sericea)* damage reduces the yield of rice crop by up to 47%. This pest also vectors Rice Yellow Mottle Virus disease which is very destructive in rice production system.
What is it? (TIMP description)	Integrating pest management strategies for the control of leaf mining beetles includes cultural practices, biopesticides, biological control and synthetic chemicals. These are;

	Cultural practices • Use close proper spacing. Close spacing encourages infestation. • Keep bunds and surroundings free of grass weeds. • Destroy stubbles and avoid ratooning. • Ensure balanced nutrition, and avoid excessive nitrogen application. • Plant resistant or tolerant varieties. **Biological management** • **Application of biopesticides** as recommended. such *Bacillus thuringiensis* v. kurstaki formulations 2% @2g/l or *Metarhizium anisopliae* or *Beauveria bassiana* @ 5 g/ litter at 5-10% infestation. www.pcpb.go.ke. **Chemical management** • Application of systemic neonicotinoids to seeds can provide some protection to seeds and seedlings. • Spray with lambda-cyhalothrin www.pcpb.go.ke
Justification	The leaf mining beetles infestation cause yield loses of up to 100% in rice in Kenya if not controlled. The infestation by this pest also compromises its quality of the crop. Currently rice farmers use a lot of synthetic pesticides in the control of this pest and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals •
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies

	• A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted if any	Counties where irrigated and upland rice is grown.
Counties where TIMP will be up scaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas. •
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies

	• Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES18500.00
Estimated returns	KES 84500.00
Gender issues and concerns in development ,dissemination, adoption and scaling up	• Management of leaf mining beetles may involve use of pesticides that may be particularly harmful to men, youth and women • Limited knowledge on how to safely manage the pest to minimize food contamination due pesticide residues. • Fewer opportunities for training to youth and women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Reaching more women groups with information on management of pest

	• Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of integrated approaches to management of the pest
VMG issues and concerns in development, dissemination, adoption and scaling up	• Dissemination approaches that are not always easy to understand or implement • Safety concerns for VMGs when handling the chemical control options under the integrated approach
VMG related opportunities	• Develop friendly training approaches and materials with illustrations to enhance communication • Empower the VMGs by connecting them to financial sources to facilitate acquisition of pests management services
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	1. http://www.knowledgebank.irri.org/ 2. CABI Plantwise Plus Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires	1 - Ready for upscaling
further research**)**	
G: Contacts	
Contacts	The Centre Director, ICRIC Mwea P.O. Box 298, Kerugoya Email:kalro.mwea@kalro.org Tel No: +254 0202028217
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Farmers, Extension Agents (Public and Private), research organizations and universities, companies producing bio-pesticide / biological products as well as CGIAR's, traders, millers, seed dealers, researchers

2.9.25 Integrated management of False Smut (*Ustilaginoidea virens*) in Rice

2.9.25 TIMP name	**Integrated management of False smut (Ustilaginoidea virens) in Rice**
	  False smut spore balls are initially orange and turn greenish black when mature (*Source: IRRI Rice knowledge Bank*)

Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	The pest causes yield loss of up to 50% ifnot managed.
What is it? (TIMP description)	Integrated pest management method for control of common false smut disease is a combination of cultural, biological and chemical control methods. These are; **Cultural Practices:** • Use of clean splits/ certified seed, • Destroy infected plant materials by burying or burning, • Regularly weed to remove alternative hosts • Practicing crop rotation for 4 seasons with beans, tomato, cassava or sweet potatoes. **Biological Control** Treat the seed before planting using biocontrol agents such as Trichoderma spp. (Trianum, Rootgard and *Pseudomonas flourescens* (Brochure) according to the manufacturers reccommendations. . **Chemical control:** • Treat seed using systemic fungicides such as carboxin +Thiram (Vitaflo), Seed Plus (Imidacloprid Metalaxyl Carbendazim 10%) according to the manufacturers recommendation. • Spray the plants at booting stage/seed head still enclosed using copper based fungicides e.g. Copper Oxychloride (Cuppracaffaro) according to the manufacturers reccommendations.
Justification	This fungus reduces the yield and quality of harvested rice grain. False smut is an internally seed-borne disease that causes chalkiness of grain resulting in reduced grain weight. A 50% seed infection will give a corresponding 50% loss in yield. Currently rice farmers use a lot of synthetic pesticides in management of this disease and this may not be safe to human consumption. Intergrated pest management (IPM) involves the use of a combination of cultural and bio-control methosd that are relatively safe to human and thed environment. Synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach should therefore be promoted in the management of this disease as it contributes to food and environment safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station

	• Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/ companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted, if any	Counties where irrigated and upland rice is grown.
Counties where TIMPs will be upscaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space

	• Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas. •
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/ companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling, if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 10,000 cost of pesticides and application

Estimated returns	KES 50,000 if the IPM management strategies are not applied (25bags/acre @ksh. 4000 per bag KES.100,000)
Gender issues and concerns in development, dissemination adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth yet important for disease management • Land ownership mainly by men who may have no interest in rice • Financial empowerment, the poor farmers lack funds to acquire inputs • Limited knowledge on how to manage the disease by women leading to crop loss • Limited information, awareness and knowledge on disease symptoms and its management by women due to illiteracy • The training materials and strategies are not always favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Empower women and youth to acquire land and other inputs such as improved varieties resistant to the disease; seed and biopesticides • Reach more women groups with information on the disease and its effective management • Well organized gender friendly markets and marketing system • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in disease management
VMG issues and concerns in development, dissemination adoption and scaling up	• Laborious disease management practices coupled by costly labour leading to depressed yields • Dissemination methods and documents that are not always easy to understand or access • Low access to markets • Financial constraints • Integrated management of the pest reduces production costs therefore VMG's can afford to produce rice with low-income inputs. Safety of VMG's is taken into account
VMG related opportunities	• Affordable IPM strategies for rice cultivation • Make friendly training materials with illustrations to enhance communication • Well organized friendly trading conditions • Inclusion of VMGs in trainings and opportunity creation in rice production • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	• http://www.plantwise.org/KnowledgeBank/CountryHome.aspx • http://www.knowlwdgebank.irri.org

	• http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases • http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases/item/false-smut • Nyamai, M., Mati, B.M., Home P.G., Odongo, B., Wanjogu, R. and Thuranira E.G. 2012. Improving land and water productivity in basin rice cultivation in Kenya through System of Rice Intensification (SRI). Agric Eng Int: CIGR Journal, 2012, 14, 2, 1-9. • LNIP SRI Manual, 2020. Miriam Otipa and Tedson Nyongesa. • Pest Control Products Board List of registered products (www.pcpb.co.ke) • Omwenga, K. G. 2014. Impact of the System of Rice Intensification on mosquito survival in rice paddies and rice yield at Mwea Irrigation Scheme, Kenya. MSc. Thesis. JKUAT. • Omwenga, K.G., Mati, B.M. and Home, P.G. 2014. Determination of the Effect of the System of Rice Intensification (SRI) on Rice Yields and Water Saving in Mwea Irrigation Scheme, Kenya. Journal of Water Resource and Protection, 6, 895-901. http://dx.doi.org/10.4236/jwarp.2014.610084. • Uphoff, N. (2007). Reducing the vulnerability of rural households through agroecological practice: Considering the System of Rice Intensification (SRI), Mondes en Development, 35:4.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	1-Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO, FCRC Kabete P.O. Box 14733-00800.Nairobi Email: cd.narl@kalro.org The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Real IPM, Dudutech, Seedco, MOALD, Agricultural Universities and Colleges, ICIPE, CABI, CGIAR IRRI, Koopert.

2.9.26 Integrated Management of Brown Spot (*Cochliobolus Miyabeanus*) in rice

2.9.26 TIMP name	**Integrated Management of Brown Spot (*Cochliobolus Miyabeanus*) in ric**
	 Brown lesions  Brown spots  Brown spot on rice leaves *Source: IRRI Rice Knowledge bank*
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss of up to 30% and loss of quality of rice due to the disease
What is it? (TIMP description)	Integrated pest management of the brown spot diseases involves the use of a combination of cultural practices, bio-control and chemical control. methods. These are; **Cultural pratcies:** • Planting clean certified seeds/seedlings • Use of tolerant rice varieties such as MWUR 2 and MWUR 4 (available at KALRO MWEA) • Removal and burning or burying in of infested plants • Use of infected rice debris as mulching materials • Regularly weed to remove some weeds that are host to the pathogen • Avoid practicing overhead irrigation to minimize spread of the pathogen by splashing • Practice crop rotation for at least 2 years to effectively manage the disease Use recommended rates of fertilizers • Practice SRI technology by application of alternative wetting-drying technique in irrigation systems to minimize the spread of this disease. **Biological Conrrol:** Spray with Azadirachtin (Neemark, Nemros, Achook), Nimbecidine or Beauvitech (*Beauveria bassiana*) or Bio-Power (*Beauveria bassiana*) or Botanigard (Azadirachtin) according to the manufacturers reccommendations. **Chemical Control:** • Dress the seeds using Seed Plus to effectively manage the disease. • Use of Iprodione (Iprode) and Azoxystrobin+ Difenoconazol (Amistartop or Ortiva) according to the manufacturers reccommendations.

Justification	Leaf spot disease is a major challenge in rice production in Kenya, occurring in most production areas. Its causes leaf spots on the leaves which can kill the whole leaf. When infection occurs in the seed, unfilled grains or spotted or discolored seeds are formed. The disease is of economic importance as it causes significant yield loss of up to 30% ab dreduces the quality of the grain. Currently rice farmers use a lot of synthetic pesticides to manage this disease and this may not be safe to human consumption. Integrated pest management should be promoted for use in rice considering that the crop is consumed widely in Kenya. This involves the use of a combination of cultural and bio-control methods that are relatively safe. Synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach will enhance food and environment safety .
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest

	• MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted, if any	Counties where irrigated and upland rice is grown.
Counties where TIMPs will be upscaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling, if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain.

	• Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 10,000 cost of pesticides and application
Estimated returns	KES 70,000 if the IPM management strategies are not applied (25 bags/acre @ksh. 4000 per bag kes 100,000)
Gender issues and concerns in development, dissemination adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth yet important for disease management • Land ownership mainly by men who may have no interest in rice • Financial empowerment, the poor farmers lack funds to acquire inputs • Limited information, awareness and knowledge on disease symptoms and its management by women due to illiteracy • The training materials and strategies are not always favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Empower women and youth to acquire land and other inputs such as improved varieties resistant to the disease; seed and biopesticides • Reach more women groups with information on the disease and its effective management • Well organized gender friendly markets and marketing system • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in disease management
VMG issues and concerns in development,	• Laborious disease management practices coupled by costly labour leading to depressed yields

dissemination adoption and scaling up	• Dissemination methods and documents that are not always easy to understand or access • Low access to markets • Financial constraints • Integrated management of the pest reduces production costs therefore VMG's can afford to produce rice with low-income inputs. Safety of VMG's is taken into account
VMG related opportunities	• Affordable IPM strategies for rice cultivation • Make friendly training materials with illustrations to enhance communication • Well organized friendly trading conditions • Inclusion of VMGs in trainings and opportunity creation in rice production • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	• http://www.plantwise.org/KnowledgeBank/CountryHome.aspx • http://www.knowlwdgebank.irri.org • http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases • http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases/item/false-smut • Nyamai, M., Mati, B.M., Home P.G., Odongo, B., Wanjogu, R. and Thuranira E.G. 2012. Improving land and water productivity in basin rice cultivation in Kenya through System of Rice Intensification (SRI). Agric Eng Int: CIGR Journal, 2012, 14, 2, 1-9. • LNIP SRI Manual, 2020. Miriam Otipa and Tedson Nyongesa. • Pest Control Products Board List of registered products (www.pcpb.co.ke) • Omwenga, K. G. 2014. Impact of the System of Rice Intensification on mosquito survival in rice paddies and rice yield at Mwea Irrigation Scheme, Kenya. MSc. Thesis. JKUAT. • Omwenga, K.G., Mati, B.M. and Home, P.G. 2014. Determination of the Effect of the System of Rice Intensification (SRI) on Rice Yields and Water Saving in Mwea Irrigation Scheme, Kenya. Journal of Water Resource and Protection, 6, 895-901. http://dx.doi.org/10.4236/jwarp.2014.610084. • Uphoff, N. (2007). Reducing the vulnerability of rural households through agroecological practice: Considering the System of Rice Intensification (SRI), Mondes en Development, 35:4.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires	1 - Ready for upscaling

validation, 3-requires further research)	
G: Contacts	
Contacts	The Centre Director, KALRO, FCRC Kabete P.O. Box 14733-00800.Nairobi Email: cd.narl@kalro.org The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa, L.
Partner organizations	Real IPM, Dudutech, Seedco, MOALD, Agricultural Universities and Colleges, ICIPE, CABI, CGIAR IRRI, Koopert.

Gaps:

- Explore use of bio-control options for brown spot diseases
- Explore the use of ITKs in disease management
- Evaluate new rice varieties for disease tolerance

2.9.27 Integrated Management of Rice Yellow Mottle Virus (RYMV) in Rice

2.9.27 TIMP name	**Integrated Management of Rice Yellow Mottle Virus (RYMV) in Rice**
	 Scatted yellow patches in a yellow mottle virus infected field (KALRO Kibos)  Yellow-Green colouration on rice leaves infected by yellow mottle virus (KALRO Kibos)
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Loss in production and productivity as the disease can cause significant crop loss of between 10% up to 100% if plants are infected early in the growing season.
What is it? (TIMP description)	This disease can be managed using Integrated Pest Management (IPM) strategies. This involves the use of cultural practices, bio-control and chemical control. **Cultural practices:**

	• Use of tolerant varieties such as Basmati 370 and 217, ITA 310, • Dsinfect all farm tools by dipping in 10 % jik solution (3.85 % sodium hypochlorite) at 50 ml / 20 lts of water for 5 min • Control weeds to ensure there are no alternate hosts of the virus • Ensure that the beetles are controlled using appropriate methods • Ensure proper agronomic practices are maintained **Biological Control:** • Use Neem-based biopesticides e.g. Nimbecidine, Achook, or Neemraj Super according to manufacturer's recommendations. • Drench the soil with Trichoderma-based biocontrol products e.g. Trichotech, Rootgard, Trianum-P, Bio cure-F 1.5 WP and Mazao to control the bacterium. **Chemical control:** Spray using Alpha-cypermethrin based products e.g. Albaz, Alfacyper, Alfagold, Alfapor or Carbosulfan based products e.g. Marshal to control the vector that transmit the virus
Justification	RYMV disease is a serious challenge in rice production in Kenya. It causes significant yield loss of up to 10 to 100% and affects quality. The virus is transmitted by several hosts including beetles, grasshoppers, cows, rats and donkeys. Currently rice farmers use a lot of synthetic pesticides in the control of this disease and this may not be safe to human consumption. Integrated pest management should be highly promoted in rice production since the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control and biopesticides that are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies

	• A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted, if any	Counties where irrigated and upland rice is grown.
Counties where TIMPs will be upscaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms

	• Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling, if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 10,000 cost of pesticides and application
Estimated returns	KES100,000 if the IPM management strategies are applied (25bags/acre @ksh. 4000 per bag kes 100,000)
Gender issues and concerns in development, dissemination adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth yet important for disease management • Land ownership mainly by men who may have no interest in rice • Financial empowerment, the poor farmers lack funds to acquire inputs • Limited information, awareness and knowledge on disease symptoms and its management by women due to illiteracy • The training materials and strategies are not always favorable to women farmers

Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Empower women and youth to acquire land and other inputs such as improved varieties resistant to the disease; seed and biopesticides • Reach more women groups with information on the disease and its effective management • Well organized gender friendly markets and marketing system • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in disease management
VMG issues and concerns in development, dissemination adoption and scaling up	• Laborious disease management practices coupled by costly labour leading to depressed yields • Dissemination methods and documents that are not always easy to understand or access • Low access to markets • Financial constraints • Integrated management of the pest reduces production costs therefore VMG's can afford to produce rice with low-income inputs. Safety of VMG's is taken into account
VMG related opportunities	• Affordable IPM strategies for rice cultivation • Make friendly training materials with illustrations to enhance communication • Well organized friendly trading conditions • Inclusion of VMGs in trainings and opportunity creation in rice production • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	• http://www.plantwise.org/KnowledgeBank/CountryHome.aspx • http://www.knowlwdgebank.irri.org • http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases • http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases/item/false-smut • Nyamai, M., Mati, B.M., Home P.G., Odongo, B., Wanjogu, R. and Thuranira E.G. 2012. Improving land and water productivity in basin rice cultivation in Kenya through System of Rice Intensification (SRI). Agric Eng Int: CIGR Journal, 2012, 14, 2, 1-9. • LNIP SRI Manual, 2020. Miriam Otipa and Tedson Nyongesa. • Pest Control Products Board List of registered products (www.pcpb.co.ke) • Omwenga, K. G. 2014. Impact of the System of Rice Intensification on mosquito survival in rice paddies and rice yield at Mwea Irrigation Scheme, Kenya. MSc. Thesis. JKUAT.

	• Omwenga, K.G., Mati, B.M. and Home, P.G. 2014. Determination of the Effect of the System of Rice Intensification (SRI) on Rice Yields and Water Saving in Mwea Irrigation Scheme, Kenya. Journal of Water Resource and Protection, 6, 895-901. http://dx.doi.org/10.4236/jwarp.2014.610084. • Uphoff, N. (2007). Reducing the vulnerability of rural households through agroecological practice: Considering the System of Rice Intensification (SRI), Mondes en Development, 35:4.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	1 - Ready for upscaling,
G: Contacts	
Contacts	The Centre Director, KALRO, FCRC Kabete P.O. Box 14733-00800.Nairobi Email: cd.narl@kalro.org The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa, L.
Partner organizations	Real IPM, Dudutech, Seedco, MOALD, Agricultural Universities and Colleges, ICIPE, CABI, CGIAR IRRI, Koopert.

Gaps:

- Explore use of Bio-control options for virus
- Explore the efficacy of ITKs in vector management of disease management
- Evaluate new rice varieties for virus tolerance

2.9.28 Integrated Management of Rice Blast (*Magnaporthe oryzae*)

2.9.28 TIMP name	Integrated Management of Rice Blast (*Magnaporthe oryzae*)
	 Leaf blast (Prof. Nick Talbot , TSL)  Neck blast(Lanoiselet, et al. 2015 , NDP14V2)  Node blast (L) and Panicle blast (R) (Lanoiselet, *et al,.(*2015 , NDP14V2)

Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	The diseases reduces the yield of rice by 70-100%.
What is it? (TIMP description)	Rice blast disease can be managed by use of Integrated pest management strategies which are a combination of cultural practices, bio-control and chemical control. **Cultural practices:** • Plant early with certified seeds from reliable sources such as NIA Mwea, Ahero, KALRO Mwea, MIARD, • Avoid excessive use of nitrogenous fertilisers, applying NPK fertiliser at recommended rates at the panicle initiation stages, • Use tolerant varieties such as NERICAs (1, 4, 10 & 11), BW 196, IR 2793-80-1, • Provide optimal water, • Practicing crop rotation with non-host crops to break the disease cycle. **Biological Control:** Use biocontrol agents such as *Trichoderma* spp (Trianum P®, Rootgard®) *Pseudomonas flourescens* (Brochure) for seed dressing at recommended rates. **Chemical Control:** Spray at maximum tillering and at panicle initiation using Carbendazim based products e.g. Chariot, Prodione based prducts such as Megaprode Lock or Trifloxystrobin and Tebuconazole based products e.g. Nativo at the manufacturers recommendation.
Justification	Rice blast disease is a serious challenge in rice production in Kenya and can cause yield loss of 70-100% %. This disease is dangerous because it can remain in rice straws for a long period of time thus becoming a source of disease infections in the subsequent rice crop. Currently rice farmers use a lot of synthetic pesticides in the control of this disease and this may not be safe to human consumption. Integrated pest management should be promoted in rice production as the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control methods that are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach will enhance the safety of food and environment.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days

	• Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted, if any	All counties growing rice in Kenya
Counties where TIMPs will be upscaled	Busia, Siaya, Kisumu and Homabay
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relavant stakeholders • Convincing farmers to use an integrated approach other than rushing to use synthetic pesticides. • Limited availability of the biopesticides and traps in agrovets closer to the farmers and at affordable prices

	• Some practices are new to majority of farmers in the arid and semi-arid zone • Market preference of certain varieties which may be susceptible to the disease • Low use of recommended agronomic practices including management of infected plants and straw • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish rice innovation platforms • Training farmers on the advantages of using IPM and the benefits to human health / food safety and environmental conservation and safety. • Availing of resources for dissemination; • Making traps, biopesticides and biologicals available and accessible • Research to develop more IPM technologies • Information dissemination on production practices • Promotion of these practices in the suitable areas • Promote marketing models that encourage collective production and marketing • Develop good policy for the use of IPM in management of pest • Involve County governments, extension, marketers and processors
Lessons learned in upscaling, if any	• Chances of successful scaling are higher when diverse value cahin stakeholders collaborate in an innovation platform • Farmers are well receptive to the technology once sensitized • Creation of awareness through demonstrations and farmer workshops helps in adoption of the IPM practices • Availability of biopesticides near farmers is key
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involvement of all gender in training on integrated management of diseases in rice production to enhance awareness and adoption; Community action in management of the disease to reduce prevalence • Environmental conditions: Research results highlighting the benefits of IPM options to environmental safety, food safety and human health due to reduction in use of synthetic pesticides; Ability to identify disease early • Market conditions: Awareness creation on the benefits of IPM to enhance consumer demand and hence increase adoption • Policy: Enabling policies guiding and supporting development and use of IPM
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 10,000 cost of pesticides and application
Estimated returns	KES 70,000 if the IPM management strategies are not applied (25 bags/acre @ KES.4000 per bag = KES.100,000)
Gender issues and concerns in development, dissemination adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth yet important for disease management • Land ownership mainly by men who may have no interest in rice • Financial empowerment, the poor farmers lack funds to acquire inputs

	• Limited knowledge on how to manage the disease by women leading to crop loss • Limited information, awareness and knowledge on disease symptoms and its management by women due to illiteracy • The training materials and strategies are not always favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Empower women and youth to acquire land and other inputs such as improved varieties resistant to the disease; seed and biopesticides • Reach more women groups with information on the disease and its effective management • Well organized gender friendly markets and marketing system • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in disease management •
VMG issues and concerns in development, dissemination adoption and scaling up	• Laborious disease management practices coupled by costly labour leading to depressed yields • Dissemination methods and documents that are not always easy to understand or access • Low access to markets • Financial constraints • Integrated management of the pest reduces production costs therefore VMG's can afford to produce rice with low-income inputs. Safety of VMG's is taken into account
VMG related opportunities	• Affordable IPM strategies for rice cultivation • Make friendly training materials with illustrations to enhance communication • Well organized friendly trading conditions • Inclusion of VMGs in trainings and opportunity creation in rice production • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	• http://www.plantwise.org/KnowledgeBank/CountryHome.aspx • http://www.knowlwdgebank.irri.org • http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases 1. http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases/item/false-smut 2. Nyamai, M., Mati, B.M., Home P.G., Odongo, B., Wanjogu, R. and Thuranira E.G. 2012. Improving land and water productivity in basin rice cultivation in Kenya through System of Rice Intensification (SRI). Agric Eng Int: CIGR Journal, 2012, 14, 2, 1-9.

	3. LNIP SRI Manual, 2020. Miriam Otipa and Tedson Nyongesa. 4. Pest Control Products Board List of registered products (www.pcpb.co.ke) 5. Omwenga, K. G. 2014. Impact of the System of Rice Intensification on mosquito survival in rice paddies and rice yield at Mwea Irrigation Scheme, Kenya. MSc. Thesis. JKUAT. 6. Omwenga, K.G., Mati, B.M. and Home, P.G. 2014. Determination of the Effect of the System of Rice Intensification (SRI) on Rice Yields and Water Saving in Mwea Irrigation Scheme, Kenya. Journal of Water Resource and Protection, 6, 895-901. http://dx.doi.org/10.4236/jwarp.2014.610084. 7. Uphoff, N. (2007). Reducing the vulnerability of rural households through agroecological practice: Considering the System of Rice Intensification (SRI), Mondes en Development, 35:4.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	1 - Ready for upscaling,
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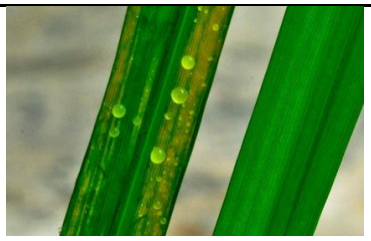
Contacts	The Centre Director, KALRO, FCRC Kabete P.O. Box 14733-00800.Nairobi Email: cd.narl@kalro.org The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa, L.
Partner organizations	Real IPM, Dudutech, Seedco, MOALD, Agricultural Universities and Colleges, ICIPE, CABI, CGIAR IRRI, Koopert.

Gaps:

1. Explore use of Bio-control options for rice blast disease
2. Explore the efficacy of ITKs in vector management of disease management
3. Evaluate new rice varieties for rice blast disease tolerance

2.9.29 Integrated Management of Bacterial Blight (*Xanthomonas oryzae pv. oryzae*)

2.9.29 TIMP name	**Integrated Management of Bacterial blight (*Xanthomonas oryzae* pv. *oryzae*)**

	  Bacterial Blight | Bacterial ooze *Source: IRRI Rice Knowledge Bank*
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Loss in productivity since bacterial blight in rice causes yield loss of up to 100%.
What is it? (TIMP description)	Thi diseases can me managed by use of Integrated pest management strategies that involves the combination of cultural, biological and chemical control methods. These are ; **Cultural practices:** • Use of resistance cultivars e.g. NERICAs 1, 4, 10 and 11, and Dourado Precoce • Application of fertilizers at recommended rates • Provide water regularly by alternate wetting and drying of the fields • Maintain a clean rice field by removing weeds, • Remove infected rice straws, ratoon and volunteer plants and burn to break the disease cycle • Disinfect all farm tools by dipping in 10 % jik solution (3.85 % sodium hypochlorite) at 50 ml / 20 lts of water for 5 min **Biological Control:** • Use Neem-based biopesticides e.g. Nimbecidine, Achook, or Neemraj Super according to manufacturer's recommendations. • Drench the soil with Trichoderma-based biocontrol products e.g. Trichotech, Rootgard, Trianum-P, Bio cure-F 1.5 WP and Mazao to control the bacterium. **Chemical control:** • Spray using copper based pesticides (Kocide 101, Kocide DF) every 10 days. • Drench or spray plants using carbendazim based fungicide such as Rodazim, Saaf, Goldazim 500 SP, Pearl 500 SC, Pearl Extra 50 % EC or use Propamocarb based products such as Previcur according to the manufacturers recommendations.
Justification	Bacterial blight causes significant yield loss of up to 100% and affects quality of rice grain. Currently rice farmers use a lot of synthetic pesticides in the control of this disease and this may not be safe to human consumption. Integrated disease management should be promoted in rice production considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control which

	are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level • KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	

Counties where already promoted, if any	Counties where irrigated and upland rice is grown.
Counties where TIMPs will be upscaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas. •
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling, if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices • Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for	• Social conditions: Involve all gender in IPM training to enhance adoption

development and upscaling	• Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time. •
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 10,000 cost of pesticides and application
Estimated returns	KES 100,000 if the IPM management strategies are not applied (25bags/acre @ksh. 4000 per bag kes 100,000)
Gender issues and concerns in development, dissemination adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth yet important for disease management • Land ownership mainly by men who may have no interest in rice • Financial empowerment, the poor farmers lack funds to acquire inputs • Limited information, awareness and knowledge on disease symptoms and its management by women due to illiteracy • The training materials and strategies are not always favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with basic technical knowledge for various operations. • Empower women and youth to acquire land and other inputs such as improved varieties resistant to the disease; seed and biopesticides • Reach more women groups with information on the disease and its effective management • Well organized gender friendly markets and marketing system • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in disease management
VMG issues and concerns in development, dissemination adoption and scaling up	• Laborious disease management practices coupled by costly labour leading to depressed yields • Dissemination methods and documents that are not always easy to understand or access • Low access to markets • Financial constraints • Integrated management of the pest reduces production costs therefore VMG's can afford to produce rice with low-income inputs. Safety of VMG's is taken into account
VMG related opportunities	• Affordable IPM strategies for rice cultivation • Make friendly training materials with illustrations to enhance communication • Well organized friendly trading conditions • Inclusion of VMGs in trainings and opportunity creation in rice production

	• Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	• http://www.plantwise.org/KnowledgeBank/CountryHome.aspx • http://www.knowlwdgebank.irri.org • http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases • http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases/item/false-smut • Nyamai, M., Mati, B.M., Home P.G., Odongo, B., Wanjogu, R. and Thuranira E.G. 2012. Improving land and water productivity in basin rice cultivation in Kenya through System of Rice Intensification (SRI). Agric Eng Int: CIGR Journal, 2012, 14, 2, 1-9. • LNIP SRI Manual, 2020. Miriam Otipa and Tedson Nyongesa. • Pest Control Products Board List of registered products (www.pcpb.co.ke) • Omwenga, K.G., Mati, B.M. and Home, P.G. 2014. Determination of the Effect of the System of Rice Intensification (SRI) on Rice Yields and Water Saving in Mwea Irrigation Scheme, Kenya. Journal of Water Resource and Protection, 6, 895-901. http://dx.doi.org/10.4236/jwarp.2014.610084. • Uphoff, N. (2007). Reducing the vulnerability of rural households through agroecological practice: Considering the System of Rice Intensification (SRI), Mondes en Development, 35:4.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO, FCRC Kabete P.O. Box 14733-00800.Nairobi Email: cd.narl@kalro.org The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa, L.
Partner organizations	Real IPM, Dudutech, Seedco, MOALD, Agricultural Universities and Colleges, ICIPE, CABI, CGIAR IRRI, Koopert.

Gaps:

- Explore use of Bio-control options for bacterial blight disease
- Explore the efficacy of ITKs in vector management of disease management
- Evaluate new rice varieties for bacterial blight tolerance

2.9.30 Integrated Management of Sheath Blight *(Rhizoctonia solani)*

2.9.30 TIMP name	**Integrated Management of Sheath blight (*Rhizoctonia solani*)**
	 Figure 8: Rice leaves forming a network of white mycelia  Sheaths at the base of culms, producing - brown, water-soaked lesions
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Rce sheath blight can cause significant crop loss ranging between 10-60% if plants are infected early.
What is it? (TIMP description)	Integrated disease management method for control of Sheath Blight disease includes a combination of cultural, biological and chemical control methods. **Cultural practices:** • Removal of infected rice residues and weeds from the field • Practice crop rotation with non-host plants • Use correct spacing of rice • Apply recommended rate of nitrogenous fertilisers. **Biological Control:** • Use Neem-based biopesticides e.g. Nimbecidine, Achook, or Neemraj Super according to manufacturer's recommendations. • Drench the soil with Trichoderma-based biocontrol products e.g. Trichotech, Rootgard, Trianum-P, Bio cure-F 1.5 WP and Mazao to control the bacterium. **Chemical control:** • Spray using copper based pesticides (Kocide 101, Kocide DF) every 10 days. • Drench or spray plants using carbendazim based fungicide such as Rodazim, Saaf, Goldazim 500 SP, Pearl 500 SC, Pearl Extra 50 % EC or use Propamocarb based products such as Previcur according to the manufacturers recommendations.
Justification	Rice Sheath blight disease is a serious challenge in rice production in Kenya. It is a soil-borne disease that causes significant yield loss of between 10 to 60%. Sheath blight occurs in areas with high temperature, high levels of nitrogen fertilizer, and relative humidity of crop canopy from

	85−100%. Plants are more vulnerable to sheath blight during the rainy season. Currently rice farmers use a lot of synthetic pesticides in the control of this disease and this may not be safe to human consumption. Integrated pest management should be highly advocated in rice considering that the crop is consumed very widely in Kenya. This involves the use of a combination of cultural and bio-control and biopesticides that are relatively safe. Soft synthetic pesticides are recommended as a last option to minimize their overuse. Adoption of an IPM approach would enhance food safety among the consumers and also contribute to environmental safety.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents (Public and Private), Research Organizations and Universities, NIA, Companies producing bio-pesticide/biological products, Traders, Millers, Seed dealers and Agriprenuers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Digital Platforms– Website, Dashboards, Apps, social media short message services • Mass media – Electronic and print • Publications -posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Applied Research to continually test, validate and release improved IPM strategies • A strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers to enhance promotion. • A platform for interaction for rice value chain stakeholders • Development of agronomic practices for rice that include IPM • Well organized farmer groups and networks for easier training and adoption of IPM management practices • Good marketing models and path ways to enhance access to IPM options • Support from county and national governments • Availability/accessibility and low cost of various IPM strategies would lead to successful promotion.
Partners/stakeholders for scaling up and their roles	• Research organizations (KALRO and other research organizations) – To coordinate and regulate rice research including development of varieties tolerant to the pest • MOALD&I – Provide and up-scaling of agricultural research and extension service at the national level; development of policies to guide development and use of IPM • County Governments – Provide and up-scaling of agricultural research and extension service at the county level

	• KEBS - Provide standardization, metrology and conformity assessment services through promotion of standardization, testing, and calibration facilities required in the cotton • PCPB – Regulation and registration of pest control Products • Agrochemical firms – Supply of pest control products and biocontrol agents, ensure availability, affordability and access of PIM products.
C: Current situation and future scaling up	
Counties where already promoted, if any	Counties where irrigated and upland rice is grown.
Counties where TIMPs will be upscaled	Busia, Siaya, Kisumu and Homa bay
Challenges in dissemination	• Limited research on IPM strategies in pest management • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of good agricultural practices (GAP) by farmers due to low skills and lack of knowledge in this space • Lack of appropriate facilitation in research, capacity building, and dissemination of IPM information to farmers • Farmers prioritizing use of syntheric pesticides in pest management instead of using IPM options due to high cost • Limited access to affordable biopesticides and traps in agrovets that are close to farmers • Most IPM practices are new to majority of farmers in the upland and rain-fed rice producing areas.
Suggestions for addressing the challenges	• Applied research to test, validate and release improved IPM strategies • Establish rice innovation platforms • Encourage farmers to use integrated pest management approach instead of using synthetic pesticides • Making biological control products available and affordable to farmers • Promotion of the IPM practices in all rice growing areas • Development of a policy to guide the use of IPM practices in the management of pests • Estabish strong partnership between technical personnel/extension/companies producing biologicals and biopesticides and farmers would enhance promotion of IPM practices and feedback.
Lessons learned in upscaling, if any	• Integrated pest management is environmentally safe and ecologically sustainable and should be promoted. • Over-use and misuse of synthetic pesticides has side effects on human, envroment and and the entire food chain. • Chances of successful up scaling of IPM practices is higher when diverse value chain stakeholders collaborate in an innovation platform • Farmers are receptive to the technology once sensitized on how it works and its benefits • Awareness creation through demonstrations, farmer meetings enhances adoption of IPM practices

	• Availability of affordable biopesticides near farmers is crucial for adoption of aspects of IPM.
Social, environmental, policy and market conditions necessary for development and upscaling	• Social conditions: Involve all gender in IPM training to enhance adoption • Environmental: Highlight the research results showing the benefits of IPM options to environmental safety, food safety and human health • Market conditions: Availability of IPM products close to the farmers is essential for their uptake. Capacity build farmers on benefits of IPM to create market demand • Policy: Provide enabling policy guiding and supporting the use of IPM and review policy from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 10,000 cost of pesticides and application
Estimated returns	KES 60,000 if the IPM management strategies are not applied (25 bags/acre @ksh. 4000 per bag kes 100,000)
Gender issues and concerns in development, dissemination adoption and scaling up	• Labour intensity in planting, weeding, spraying which are mostly done by women and youth yet important for disease management • Land ownership mainly by men who may have no interest in rice • Financial empowerment, the poor farmers lack funds to acquire inputs • Limited information, awareness and knowledge on disease symptoms and its management by women due to illiteracy • The training materials and strategies are not always favorable to women farmers
Gender related opportunities	• Opportunities for youth employment in implementing IPM protocols are possible with little technical knowledge for various operations. • Empower women and youth to acquire land and other inputs such as improved varieties resistant to the disease; seed and biopesticides • Reach more women groups with information on the disease and its effective management • Well organized gender friendly markets and marketing system • Make gender friendly training materials with illustrations to enhance communication to all gender • Use the FFBS strategy for effective training of farmer groups on use of IPM in disease management
VMG issues and concerns in development, dissemination adoption and scaling up	• Laborious disease management practices coupled by costly labour leading to depressed yields • Dissemination methods and documents that are not always easy to understand or access • Low access to markets • Financial constraints • Integrated management of the pest reduces production costs therefore VMG's can afford to produce rice with low-income inputs. Safety of VMG's is taken into account
VMG related opportunities	• Affordable IPM strategies for rice cultivation • Make friendly training materials with illustrations to enhance communication • Well organized friendly trading conditions

	• Inclusion of VMGs in trainings and opportunity creation in rice production • Empower the VMGs by connecting them to financial sources
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	• http://www.plantwise.org/KnowledgeBank/CountryHome.aspx • http://www.knowlwdgebank.irri.org 1. http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases 2. http://www.knowledgebank.irri.org/training/fact-sheets/pest-management/diseases/item/false-smut 3. Nyamai, M., Mati, B.M., Home P.G., Odongo, B., Wanjogu, R. and Thuranira E.G. 2012. Improving land and water productivity in basin rice cultivation in Kenya through System of Rice Intensification (SRI). Agric Eng Int: CIGR Journal, 2012, 14, 2, 1-9. 4. LNIP SRI Manual, 2020. Miriam Otipa and Tedson Nyongesa. 5. Pest Control Products Board List of registered products (www.pcpb.co.ke) 6. Omwenga, K.G., Mati, B.M. and Home, P.G. 2014. Determination of the Effect of the System of Rice Intensification (SRI) on Rice Yields and Water Saving in Mwea Irrigation Scheme, Kenya. Journal of Water Resource and Protection, 6, 895-901. http://dx.doi.org/10.4236/jwarp.2014.610084. 7. Uphoff, N. (2007). Reducing the vulnerability of rural households through agroecological practice: Considering the System of Rice Intensification (SRI), Mondes en Development, 35:4.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	1 - Ready for upscaling,
G: Contacts	
Contacts	The Centre Director, KALRO, FCRC Kabete P.O. Box 14733-00800.Nairobi Email: cd.narl@kalro.org The Centre Director, KALRO, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO; Ngari B. M., Otipa M. J. and Wasilwa L.
Partner organizations	Real IPM, Dudutech, Seedco, MOALD, Agricultural Universities and Colleges, ICIPE, CABI, CGIAR IRRI, Koopert.

2.10 WEED MANAGEMENT IN RICE

2.10.1 Integrated Weed Management (IWM) in upland and lowland rice

2.10.1TIMP Name	Integrated Weed Management (IWM) in upland and lowland rice
Category (i.e. technology, innovation or management practice)	**Management practice**  Yellow nutsedge (*Cyperus esculentus*)  Water hyacinth (*Eichhornia crassipes*)  Barnyard grass (*Echinochloa species*) in rice  Weeds in a lowland rice field  Wild rice  *Eichinochloa* spp. And other grass weeds Source: KALRO Mwea
A: Description of the technology, innovation or management practice	
Problem addressed	Diverse annual and perennial grass and broadleaved weed species infestation, improper control measures that lead to low and poor quality yields of rice.
What is it? (TIMP description)	Integrated Weed Management (IWM) is the management of weeds using two or more appropriate approaches such as preventive, land preparation before planting, use of mulch (biodegradable or synthetic), crop rotation, intercropping and chemical use, among others, depending

	on the weed types and intensity in the field. Difficult to control common weeds in rainfed upland rice include; *Striga* spp., perennial sedges e.g yellow nutsedge (*Cyperus esculentus*), grasses e.g couch grass (*Digitaria abyssinica*) and broad leaved weeds e.g, purselane (*Portulaca oleracea*) among others. In lowland rise includes: perennial sedges and water hyacinth (*Eichhornia crassipes*). Other grass weeds include *Echinochloa* sp. E.g Barnyard grass ()
Justification	Uncontrolled weed growth in rice causes yield losses ranging from 40 to 85 percent and complete loss may occur in some instances. Weeds are among major limiting factors of rainfed upland rice production throughout the world. Present control methods are unsuitable for continuous or large scale farming. There is need for alternative methods for upland rice production for large scale farming.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice farmers, researchers, extension service providers, input providers
Approaches used in dissemination	• Farmer Field Business Schools (FFBS) • Field days and farmer to farmer approach • Agricultural shows and trade fairs • Electronic and mass media • Agricultural Innovation Platforms (AIPs) • Seminars and workshops
Critical/essential factors for successful promotion	• Access to the technology • Sensitization on the technology • On-farm demonstrations • Enhanced funding for technology dissemination
Partners/stakeholders for scaling up and their respective roles.	• Pests Control Products Board (PCPB) for regulation and • approval of herbicides • Farmer co-operative Societies (FCS) for mobilization and sensitization of farmers, availing products to farmers • Agrochemical Manufacturers to avail and distribute products • Financial institutions to facilitate acquisition of products by FCS • Research organizations and Universities to validate and upscale the technology • Development partners, National and County governments to finance and facilitate extension services to the farmers • Extension service providers for dissemination and sensitization of farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMPs will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in development and dissemination	• Weak research-extension-farmer linkage in technology delivery • Low awareness of Integrated Weed Management (IWM) practice • Weak collaboration among stakeholders
Suggestion for addressing the challenges	• Strengthen the research-extension-farmer linkage through Agricultural Innovative Platforms (AIPs) • Sensitization campaigns and on-farm demonstrations • Strengthen collaboration among the stakeholders

Lesson learned in upscaling if any	• Integrated approaches of weed management are more effective than use of one control method. • Continuous use of herbicides is an environmental, health and social hazard hence the need to follow instructions on the label. This prevents toxicity of next crop if the cycle of previous crops is short enough and safe guards the consumers.
Social, environmental, policy and market conditions necessary for development and up-scaling	• IWM will be socially acceptable (particularly to the women and youth who form the labour force in rice production) in the target communities • Policy environment will be enabling for upscaling of the TIMP • The market will be willing and able to absorb the extra produce arising from the increased yields
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ploughing and harrowing by tractor - KES 8,000 per acre. Manual weeding reduced to about KES 8,000 per acre (8 casuals per day @ Ksh 500 for 2 weedings). Total cost is about - KES 16,000 per acre
Estimated returns	Lowest yield unshelled is 25bags x 90kg bag @ KES 60 (lowest price) - KES 135,000 per acre depending on variety. **Estimated returns:** Income KES 135,000 - Total cost (16,000) - KES 119,000 per acre.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Most rice fields are owned by men yet it is women and the youths who perform most of the weeding activities • Women and youths have limited access to productive resources such as land and farm inputs compared to men • Women and youths have limited access to training and extension services compared to men. • Women have less access to agricultural information and knowledge on integrated weeds management.
Gender related opportunities	• Opportunities exist for males youth to provide spraying services in weed management • Affirmative action opportunities exist for women and youths to acquire credit to adopt IWM approaches • Training opportunities in integrated weed management to reduce crop loss due to inappropriate weed management
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from development and dissemination activities • There is low adoption by VMGs due to lack of awareness
VMG related opportunities	• Opportunities exist for VMGs to own agrovet shops and for marketing • Formation of groups by VMGs to access and/or provide services in IWM
E: Case studies/profiles of success stories	
Success stories	Central Kenya and Lake Victoria region counties
Application guidelines for users	1. Krupnik, T.J., Naher, K. Islam, S., Hoque, M.A., Roy, A., Kumar, V., Hossain, I., Hossain, K., Shahrin, S., Gathala, M.K., Shrestha,

	A., Uddin, S.M.N. (2017). Integrated weed management: Experiential learning modules. Mexico, D.F. Training of Trainers Modules. 2. Umair Riaz, Tayyaba Samreen, Sidra-tul-mutaha, Haaris Ali Arshad, Zulqernain Nazir, Sehrish Kanwal (2020). Weed Management in Rice. Austin Publishers group.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	1. Ready for upscaling
G: Contacts	
Contacts	Centre Director, KALRO-Kabete P.O. Box 14733-00800, Nairobi Tel:+254-0721822312 Email: cd.narl@kalro.org
Lead organization and scientists	KALRO , Kabete Dr. Momanyi Violet and Dr. Hottensiah Mwangi
Partner organizations	KALRO, relevant NGOs, CBOs, County Governments, PCPB, KEPHIS

Research Gaps:
Extensive research to determine alternatives to the methods presently being used to manage weeds in upland rice.

2.10.2 Integrated management of Striga in upland rice

2.10.2 TIMP Name	**Integrated management of Striga in upland rice**
Categories (i.e. technology innovation or management practice)	Management practice  Source: Wikipedia
A: Description of the technology, innovation or management practice	
Problem to be addressed	Parasitic Striga weed infestation and damage to upland rice leading to damage and 30% to 100% yield loss.
What is it? (TIMP description)	A technology that combines various control methods to control invasive parasitic Striga (*Striga haemethicaI)* weed species. Long-term control approaches focus on controlling the production of new striga seeds, reducing the number of seeds in the soil and managing the germinated

	weeds in the fields. Management measures include the following where applicable: **Trap cropping** Planting effective trap crops such as legumes (eg ground nuts, cowpea), cotton, sunflower and linseed between rice rows in an infested field will induce germination of *Striga* seeds but will not support attachment of the parasite while planting. *Desmodium* will inhibit striga seed germination. **Weeding** Several seasons of hand weeding before the weed flowers is required before competition with rice crop begins. Uprooted weeds can be buried in a dip pit. **Crop rotations** Rotation with legumes or trap crops such as cotton and soy beans can reduce striga seed banks but selection of a rotation crop should be based on socio-economic factors such as market value, and the ability to inhibit or stimulate striga seeds to germinate. Seriously infested areas should be rotated to non-host crops for two or more years followed by closely supervised weeding. **Soil Fertility:** Organic matter and fertilizer additions may help induce suppressiveness. Striga seed banks can be readily reduced in suppressive soils. **Herbicide control:** **a) Pre-emergent** herbicides are applied on moist soil after field preparation and within 12 hours after planting before both the crop and weeds have emerged. Striga is a broadleaf plant, pre-plant herbicides such as Atrazine (150-170 mls in 20 litres water) effectively prevent seed germination. **b) Post-emergent selective** herbicides such as 2,4-D (100-150 ml in 20 litres water) sprayed between rice rows 2-3 weeks after germination will effectively control broad leaved weeds. **Caution** *Rice is vulnerable to stalk twisting and lodging if 2,4-D is sprayed into the leaf whorl. Spraying should be done by a trained person using a hood fixed on the sprayer*. **c) Post-emergent non selective, broad spectrum herbicides** such as glyphosate (100-200 ml in 20 litres of water) mostly used in zero and minimum tillage may be applied as directed but guarded with a hood to avoid burning the crop. **Push pull technology**: Although manual removal reduces re-infestation, it is thought to be uneconomical since most damage is done even before the weed emerges. Thus any control strategy has to begin within the soil. Allelopathic legumes such as Desmodium are intercropped with rice and plots surrounded with napier or brachiaria grass. Desmodium roots releases chemicals into the soil that suppress striga and stop it from growing on the rice. **Biological control of striga**

	Soil microbes are possible biological control agents that can be used to manage Striga. The microbes enhance rice growth to withstand Striga damage and facilitate uptake of micronutrients such as water, and phosphorus (P) from soil through extraradical fungal hyphae, which reduces Striga infection. In addition, the soil microbes lower Striga infestation and decreases its germination and the release of root exudates.
Justification	Striga weed is a parasite which feeds on upland rice and may cause crop losses of up to 100%. Plants infested with striga weeds hardly grow more than one foot tall. Women spend a lot of time pulling striga from the fields. Early detection of the weed followed by a well-coordinated rapid response will increase the likelihood of eradication or containment of its invasions. It is a difficult weed to control due to its life cycle and parasitic habit to plants. A holistic line of action with multi-disciplinary approaches focusing on strengthening national systems to better prevent, eradicate, control and manage the weeds could be effective in its control.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice farmers, Researchers, Environmentalists, County governments, Input stockists and Agrodealers
Approaches used in dissemination	• Farmer field and business Schools(FFBS) • Agricultural Innovation Platforms (AIP) • Training workshops, Seminars, Meetings • Promotional materials (posters/ brochures/ leaflets/ manuals) • Demonstrations and field days • On-farm trials, • Print media, conferences and journals
Critical/essential factors for successful promotion	• Availability of inputs for practical demonstrations • Applied and adaptive Research to test, validate and release intercropping system in rice varieties • A platform for interaction of rice value chain stakeholders • Establish demos and organize field days with farmer groups and stakeholders
Partners/stakeholders for scaling up and their respective roles.	• County extension staff • NGOs, Private sectors e.g. seed company and seed dealers • Scientists from Research organizations (KALRO, relevant Universities) to provide proper recommendations to disseminate the TIMP • Agro-dealers and chemical companies to provide registered herbicides
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMPs will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in development and dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of integrated weed management approaches • Limited knowledge integrated weed management approaches by farmers • Inadequate training and limited extension staff

Suggestion for addressing the challenges	• Facilitation of training for county extension staff on the technology • Establish rice innovation platforms to promote the technology • Conduct demos and field days and involvement of stakeholders e.g. chemical companies and agro-dealers. • Develop information, e.g. manuals, pamphlets, on integrated management of striga and disseminate to various stakeholders • Awareness creation on when and how to use herbicides in order to avoid residues in the crop
Lesson learned in upscaling if any	• Intercropping rice with crops such as groundnut and desmodium reduce striga weed in rice. • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Training and demonstration to farmers on the technology. • Creation of awareness through demonstrations and farmer field days will help in adoption technology • Availability of market is essential • Partnership is important in technology dissemination and adoption.
Social, environmental, policy and market conditions necessary for development and up-scaling	• Training of stakeholders to understand the effectiveness of integrated management of striga approach in rice. • Addressing the environmental and social concerns related to use of herbicides and residues in the crop. • A functional agro-dealer network to supply recommended herbicides when required by the farmers and to put in place a safety plan for safe disposal of empty containers and expired products.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ploughing and harrowing by tractor - KES 8,000 per acre. Herbicide cost plus spraying about KES 6,000 per acre Other management measures about KES 3,000. Total cost is about - KES 17,000 per acre
Estimated returns	Lowest yield unshelled is 25bags x 90kg bag @ KES 60 (lowest price) - KES 135,000 per acre depending on variety. **Estimated returns:** Income KES 135,000 - Total cost (17,000) - KES 118,000 per acre.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Most of the produced rice is owned by men yet its women and the youth who perform most of the weeding activities • Women and youths have limited access to productive resources such as land and farm inputs • Women and youths have limited access to training and extension services. • Women have less access to agricultural information and knowledge on IWM of striga • Insufficient knowledge among various genders could lead to inappropriate use and hence reduced yields • High cost of inputs required for striga management
Gender related opportunities	• Opportunities exist for males youth to provide management options and services in Striga weed management

	• Affirmative action opportunities exist for women and youths to acquire the required credit to adopt IWM approaches • Training opportunities in integrated weed management to reduce crop loss due to inappropriate weed management
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to training and extension services. • Due to their social status VMGs are often excluded from development and dissemination activities. • There is low adoption by VMGs due to lack of awareness.
VMG related opportunities	• Opportunities exist for VMGs to own agrovet shops and for marketing • Formation of groups by VMGs to access and/or provide services in IWM
E: Case studies/profiles of success stories	
Success stories	Not yet determined practiced in Kenya
Application guidelines for users	1. Jamil, M., Kountche, B. A., and Al-Babili, S. (2021). Current progress in Striga management. *Plant Physiol.* 185, 1339–1352. 2. Mercyline Tata (2020). How to Control Striga Using Push-Pull Technology. http://www.icipe.org. 3. **ICIPE -** International Centre of Insect Physiology and Ecology: Desmodium intercropping eliminates striga threat and improves food security in Africa. http://www.push-pull.net/striga. 4. Krupnik, T.J., Naher, K. Islam, S., Hoque, M.A., Roy, A., Kumar, V., Hossain, I., Hossain, K., Shahrin, S., Gathala, M.K., Shrestha, A., Uddin, S.M.N. (2017). Integrated weed management: Experiential learning modules. Mexico, D.F. Training of Trainers Modules.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	5. Requires validation
G: Contacts	
Contacts	Centre Director, KALRO-Kabete P.O. Box 14733-00800, Nairobi Tel:+254-0721822312 Email: cd.narl@kalro.org
Lead organization and scientists	KALRO , Kabete Dr Momanyi Violet and Dr Hottensiah Mwang
Partner organizations	KALRO County Governments and Extension Staff Farmer Groups KEPHIS and Relevant CBOs and NGOs

Resarch gaps:

1. Research on rice varieties **resistant to Striga**
2. **Research on integrated management options for Striga control**
3. Research, validation and release of bio-control agents

2.10.3 Integrated management of Water hyacinth in lowland rice

2.10.3 TIMP name	**Integrated management of Water hyacinth in lowland rice**
Category (i.e. technology, innovation or management practice)	Management practice  Water hyacinth (*Eichhornia crassipes)*
A: Description of the technology, innovation or management practice	
Problem to be addressed	Infestation of invasive water hyacinth damage to lowland rice leading to damage and low yield of about 278.7 - 475.4kg of rice per acre.
What is it? (TIMP description)	A technology that combines various control methods to control invasive parasitic water hyacinth (*Eichhornia crassipes)* weed species. Long-term control approaches focus on controlling the production of new water hyacinth seeds, reducing the number of seeds in the soil and managing the germinated weeds in the fields. Management measures include the following where applicable: **Solarization** Repeated solarization of the soil using the right size of transparent polythene plastic will kill the rhizomes, seeds and the young seedlings. **Crop rotations** Seriously infested areas should be rotated to non-host crops for two or more years followed by closely supervised weeding. **Herbicide control:** **a) Pre-emergent** herbicides are applied on moist soil after field preparation and within 12 hours after planting before both the crop and weed have emerged. Water hyacinth is a broadleaf plant, pre-plant herbicides such as Atrazine (150-170 mls in 20 litres water) effectively prevent seed germination. **b) Post-emergent selective** herbicides such as 2,4-D (100-150 ml in 20 litres water) sprayed between rice rows 2-3 weeks after germination will effectively control broad leaved weeds. **Caution**

	Rice is vulnerable to stalk twisting and lodging if 2,4-D is sprayed into the leaf whorl. Spraying should be done by a trained person using a hood fixed on the sprayer. **c) Post-emergent non selective, broad spectrum herbicides** such as glyphosate (100-200 ml in 20 litres of water) mostly used in zero and minimum tillage may be applied as directed but guarded with a hood to avoid burning the crop. **Biological methods**: Use of Semi-aquatic grasshopper *Cornops aquaticum* and beetles to feed on the weed. A weevil, *Neochetina eichhorniae* Warner, has effectively reduced water hyacinth populations in countries such as South Africa. Three species of weevil, *Neochetinabruchi, N. eichhorniae*, and water hyacinth borer *Sameodes albiguttalis* released by United States Department of Agriculture reduced water hyacinth population. The adults feed on the leaf pseudolamina and petioles by removing tissues and the larvae tunnel inside the petioles and the crown.
Justification	Water hyacinth weed infestation in lowland rice leads to damage and low yield
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice farmers, Researchers, Environmentalists, County governments, Input stockists and Agrodealers
Approaches to be used in dissemination	• Farmer field and business Schools(FFBS) • Agricultural Innovation Platforms (AIP) • Training workshops, Seminars, Meetings • Promotional materials (posters/ brochures/ leaflets/ manuals) • Demos and field days • On-farm trials, demo plots • Print media, conferences and journals
Critical/essential factors for successful promotion	• Availability of inputs for practical demonstrations • Applied and adaptive Research to test, validate and release the technology in rice varieties • A platform for interaction of rice value chain stakeholders • Conduct demos and the field days with farmer groups and stakeholders
Partners/stakeholders for scaling up and their roles	• County extension staff, • NGOs, Private sectors e.g. seed company and seed dealers • Scientists from Research organizations (KALRO, relevant Universities) to provide proper recommendations to disseminate the Technology. • Agro-dealers and chemical companies to provide registered herbicides
C: Current situation and future scaling up	
Counties where already promoted if any	None

Counties where TIMP will be promoted	Busia, Homabay, Kisumu, Siaya,
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Limited knowledge on IWM by farmers • Inadequate training and limited extension staff
Suggestions for addressing the challenges	• Establish rice innovation platforms to promote the technology to facilitate interaction of farmers with relevant stakeholders • Conduct demos and field days and involvement of stakeholders e.g. farmers, chemical companies and agro-dealers. • Facilitation of training for county extension staffs on IWM • Develop information, e.g. manuals, pamphlets, on integrated management of water hyacinth and disseminate to stakeholders • Awareness creation on when and how to use herbicides in order to avoid residues in the crop
Lessons learned	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Training and demonstration to farmers on the technology. • Integrated management of water hyacinth will manage the weed in rice fields. • Awareness creation through demonstrations and farmer field days will help in adoption of IWM approaches • Availability of market is essential • Partnership is important in dissemination and adoption of this technology.
Social, environmental, policy and market conditions necessary	• Training of stakeholders to understand the effectiveness of integrated management of water hyacinth in rice. • Addressing the environmental and social concerns related to use of herbicides and residues in the crop. • A functional agro-dealer network to supply recommended herbicides when required by the farmers and to put in place a safety plan for safe disposal of empty containers and expired products.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ploughing and harrowing by tractor - KES 8,000 per acre. Herbicide cost plus spraying about KES 6,000 per acre Other management measures about KES 3,000. Total cost is about - KES 17,000 per acre
Estimated returns	Lowest yield unshelled is 25bags x 90kg bag @ KES 60 (lowest price) - KES 135,000 per acre depending on variety. **Estimated returns:** Income KES 135,000 - Total cost (KES17,000) - KES 118,000 per acre

Gender issues and concerns in development, dissemination, adoption and scaling up	• Most of the produced rice is owned by men yet its women and the youth who perform most of the weeding activities • Women and youths have limited access to productive resources such as land and farm inputs • Women and youths have limited access to training and extension services. • Women have less access to agricultural information and knowledge on IWM of water hyacinth • Insufficient knowledge among various genders could lead to inappropriate use and hence reduced yields • High cost of inputs required for water hyacinth management
Gender related opportunities	• Opportunities exist for males youth to provide services in weed management • Affirmative action opportunities exist for women and youths to acquire the required credit to adopt IWM approaches • Training opportunities in integrated weed management to reduce crop loss due to inappropriate weed management
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to training and extension services. • Due to their social status VMGs are often excluded from development and dissemination activities. • There is low adoption by VMGs due to lack of awareness.
VMG related opportunities	• Opportunities for training, marketing and operating agrovet shops. • Opportunities for VMGs in generating additional income from developing alternative products from hyacinth weed hence increasing productivity of rice • Formation of groups among VMGs to access financial resources and technical knowhow
E: Case studies/profiles of success stories	
Success stories	Biological control using beetles controlled the weed in lake Victoria during Lake Victoria Environment Management Project (LVEMP) although the weed control did not continue after the end of project.
Application guidelines for users	1. Krupnik, T.J., Naher, K. Islam, S., Hoque, M.A., Roy, A., Kumar, V., Hossain, I., Hossain, K., Shahrin, S., Gathala, M.K., Shrestha, A., Uddin, S.M.N. (2017). Integrated weed management: Experiential learning modules. Mexico, D.F. Training of Trainers Modules. 2. Jiménez, Maricela (2014). Progress on water hyacinth (*Eichhorni acrassipes*) management. Food and Agriculture Organization of theUnited Nations. 3. Aman, K. G. and Dipak, Y. (2020). Biological Control of Water Hyacinth. Environmental Contaminants Reviews (ECR). 3(1): 37-39.
F: Status of TIMP readiness (1. Ready for upscaling: 2.Requires validation; 3.Requires further research	2. Requires further research

G: Contacts	
Contacts	Centre Director, KALRO-Kabete P.O. Box 14733-00800, Nairobi Tel:+254-0721822312 Email: cd.narl@kalro.org
Lead organization and scientists	KALRO , Kabete Dr. Momanyi Violet and Dr. Hottensiah Mwangi
Partner organizations	KALRO, relevant NGOs, CBOs, County Governments, KEPHIS

Research Gaps:

- Research, validation and release of bio-control agents for weed management in rice e.g. weevils and semi-aquatic grasshoppers

2.10.4 Flooding for weed management in lowland rice

2.10.4 TIMP Name	Flooding for weed management in lowland rice
Category (i.e. technology, innovation or management practice)	Management Practice   Flooded rice field. Source: BM Ngari, KALRO Mwea 
A: Description of the technology, innovation or management practice	
Problem addressed	Rice yield losses and reduced quality due to competition for growth resources such as water, nutrients and space by weeds.
What is it? (TIMP description)	This is a technology used to suffocate, weaken and kill weed species through flooding rice fills with water for a certain period.
Justification	Weeds constitute a major problem for the large-scale adoption of direct-seeded rice, with yield losses of ~20 % of attainable yield or even total loss if not controlled. Flooding of fields is the most effective method to control weeds in rice. Flooding to a depth of 10 cm prevents germination of most weed seeds and kills the majority of weed

	seedlings. For flooding to be successful, water levels must be maintained and fields well levelled to ensure an even depth of water.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice farmers, Researchers, Environmentalists, County governments, Water providers
Approaches used in dissemination	• Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Training workshops, Seminars, Meetings • Promotional materials (posters/ brochures/ leaflets/ manuals) • Demos and field days • On-farm trials, demo plots • Print media, conferences and journals
Critical/essential factors for successful promotion	• Availability of water for flooding • A platform for interaction of rice value chain stakeholders • Conduct demos and field days with farmer groups and stakeholders
Partners/stakeholders for scaling up and their respective roles	• KALRO to provide research services • County governments and MoALD to provide extension services, farmer mobilization and policy formulation • Relevant CBOs and NGOs to provide micro financing services • County extension staffs
C: Current situation and future scaling up	
Counties where already promoted if any	All lowland growing regions
Counties where TIMP will be scaled up	Lake Victoria and Central Kenya regions
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Limited knowledge on the technology by farmers • Inadequate training and limited extension staff
Recommendations for addressing the challenges	• Facilitation of training for county extension staffs • Establish rice innovation platforms to promote the technology • Involve stakeholders including farmers, chemical companies and agro-dealers. • Develop information, e.g. manuals, pamphlets and disseminate to various stakeholders • Awareness creation on when and how to flood effectively.
Lessons learned	• Effective flooding of rice fields effectively manages weeds in lowland rice. • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Training and demonstration to farmers on the technology is essential for adoption. • Awareness creation through demonstrations and farmer field days will help in adoption of the technology

	• Availability of market is essential • Partnership is important in dissemination and adoption of this technology.
Social, environmental, policy and market conditions necessary	Sensitize communities on effectiveness of the technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ploughing and harrowing by tractor - KES 8,000 per acre. Flooding of the field is about KES 6,000 per acre. Total cost is about - KES 14,000 per acre
Estimated returns	Lowest yield unshelled is 25bags x 90kg bag @ KES 60 (lowest price) - KES 135,000 per acre depending on variety. **Estimated returns:** Income KES 135,000 - Total cost (KES 14,000) - KES 121,000 per acre.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Most of the produced rice is owned by men yet its women and the youth who perform most of the weeding activities • Women and youths have limited access to productive resources such as land and farm inputs • Limited access to water for flooding in the lowlands • Women and youths have limited access to training and extension services. • Women have less access to agricultural information and knowledge on flooding as a weed management option
Gender related opportunities	• Opportunities exist for males and youth males in planting, flooding the rice fields and marketing the crop. • Affirmative action opportunities exist for women and youths to acquire the required credit
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to training and extension services. • Due to their social status VMGs are often excluded from development and dissemination activities. • VMGs have limited access to information on production techniques. • There is low adoption of technologies by VMGs due lack of awareness due to their status.
VMGs related opportunities	• Opportunities for training, marketing and operating agrovet shops.
Success stories	• Flooding is commonly used in regions that grow lowland rice
Application guidelines for users	1. Krupnik, T.J., Naher, K. Islam, S., Hoque, M.A., Roy, A., Kumar, V., Hossain, I., Hossain, K., Shahrin, S., Gathala, M.K., Shrestha, A., Uddin, S.M.N. (2017). Integrated weed management: Experiential learning modules. Mexico, D.F. Training of Trainers Modules.
F: Status of TIMP Readiness (1. Ready for up-scaling; 2. Requires validation; 3. Requires Research)	1. Ready for up-scaling
G: Contacts	

Contacts	Centre Director, KALRO-Kabete P.O. Box 14733-00800, Nairobi Tel:+254-0721822312 Email: cd.narl@kalro.org
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Partner organizations	KALRO, relevant NGOs, CBOs, County Governments, KEPHIS

2.10.5 Chemical (Herbicide) weed control in upland and lowland

2.10.5 TIMP Name	**Chemical (Herbicide) weed control in upland and lowland**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Rice yield losses and reduced quality due to crop damage by competition for growth resources such as water, nutrients and space by weeds.
What is it?(TIMP description)	This is a management practice used to control the germination and growth of weed species through application of herbicides to weeds or the soil.
Justification	Uncontrolled weed growth in rice causes yield losses of up to 85 percent. Considering the problems associated with other methods of weed control, herbicides may offer the most practical, effective and economical means of reducing weed competition, crop losses and production costs in upland rice. They are one of the options of weed control suitable for large scale rice production.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice farmers, Researchers, Environmentalists, County governments, Water providers
Approaches used in dissemination	• Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Training workshops, seminars, meetings • Promotional materials (posters/ brochures/ leaflets/ manuals) • Demos and field days • On-farm trials, demo plots • Print media, conferences and journals
Critical/essential factors for successful promotion	• Private sector to avail commercialized herbicide products • Extension staff who are well trained on handling and management of herbicides • A platform for interaction of rice value chain stakeholders • Demonstrations and field days with farmer groups and stakeholders to create awareness •

Partners/stakeholders for scaling up and their respective roles	• KALRO to provide research services • County governments and MoALD to provide extension services, farmer mobilization and policy formulation • Relevant CBOs and NGOs to provide extension and micro financing services • Agrodealers to provide registered herbicides
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMP will be promoted	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Limited knowledge on chemical weed control by farmers • Inadequate training and limited extension staff
Suggestions for addressing the challenges	• Establish rice innovation platforms to facilitate interaction of rice farmers with relevant stakeholders • Train agricultural extension county officers as TOTs on chemical weed control to transfer skills to farmers • A plan for proper disposal of the herbicide containers to be put in place to avoid polluting the environment
Lessons learned	• Effective application of herbicides controls weeds effectively in rice. • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Training and demonstration to farmers on the technology is essential for adoption. • Awareness creation through demonstrations and farmer field days will help in adoption of the management practice • Availability of market is essential • Partnership is important in dissemination and adoption of a technology.
Social, environmental, policy and market conditions necessary	• Sensitization of communities on the chemical weed management practices for sensitive rice young plants. • Chemical weed control will be socially acceptable (particularly to the women are part of the labour force in rice production) in the target communities. • Policy environment will be enabling for upscaling of the TIMP • The market will be willing and able to absorb the extra produce arising from the increased yields. • Farmer training on conservation of biodiversity and especially preservation of pollinators when using herbicides for increased productivity.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ploughing and harrowing by tractor - KES 8,000 per acre. Herbicide plus spraying is about KES 6,000 per acre (8 casuals per day @ KES 500 for 2 weedings). Total cost is about - KES 14,000 per acre

Estimated returns	Lowest yield unshelled is 25bags x 90kg bag @ KES 60 (lowest price) - KES 135,000 per acre depending on variety. **Estimated returns:** Income KES 135,000 - Total cost (KES14,000) - KES 121,000 per acre.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Most of the produced rice is owned by men yet its women and the youths who perform most of the weeding activities • Women and youths have limited access to productive resources such as land and chemicals compared to men • Use of chemical herbicides for weed management requires specialized skill which most women and youth may not have • Women and youths have limited access to education, training and extension services. • Women have less access to agricultural information, technology and knowledge.
Gender related opportunities	• Opportunities exist for males and youth males in spraying, planting and marketing the crop. • Affirmative action opportunities exist for women and youths to acquire the required credit • Gender targeted training on safe use of herbicides for rice production
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to productive resources such as land compared with men. • VMGs have limited access to training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • VMGs have limited access to information on production techniques. • Use of chemical herbicides for weed management requires specialized skill which most VMGs may not have • There is low adoption of technologies by VMGs due to lack of awareness due to their status.
VMG related opportunities	• Opportunities for training, marketing and operating agrovet shops. • VMG-targeted training on safe use of herbicides for rice production
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	1. Krupnik, T.J., Naher, K. Islam, S., Hoque, M.A., Roy, A., Kumar, V., Hossain, I., Hossain, K., Shahrin, S., Gathala, M.K., Shrestha, A., Uddin, S.M.N. (2017). Integrated weed management: Experiential learning modules. Mexico, D.F. Training of Trainers Modules.
F: **Status of TIMP Readiness (**1. Ready for up-scaling; 2. Validation 3. Requires further research**)**	1. Requires further Research
G: Contacts	

Contacts	Centre Director, KALRO-Kabete P.O. Box 14733-00800, Nairobi Tel:+254-0721822312 Email: cd.narl@kalro.org
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Partner organizations	KALRO, relevant NGOs, CBOs, County Governments, KEPHIS

Research Gaps:

1. Research aimed at finding herbicides that are economical and effective

2.10.6 Solarisation for weed management in upland and lowland

2.10.6 TIMP Name	**Solarisation for weed management in upland and lowland rice**
Category (i.e. technology, innovation or management practice)	Management practice  Solarised soil using transparent polythene film. Source: infonet-biovision.org
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low and poor quality rice yields due to competition for growth resources such as nutrients from different annual and perennial weed species combined with poor weed management approaches.
What is it? (TIMP description)	Solarisation is a method where transparent/clear polythene films/plastic is used to heat the soil and kill weed seedlings and seeds in the top six inches of the soil. The cover increases soil temperatures by 10^0C or more than atmospheric. The basic phenomenon is to build up lethal high temperatures in the soil to kill rhizomes, dormant and viable seeds present. The mechanism can increase soil temperature by 8-12^{o}C over non mulched soil. Effectiveness depends on specific weed species and the heating duration.
Justification	Weed growth in rice causes yield losses of up to 85 percent. Considering the problems associated with other methods of weed control, solarization offers an effective of reducing weed competition, crop losses and production costs in upland and lowland rice. Solarization for two consecutive years is successful in controlling perennial and annual rice weeds. The Mechanism effectively breaks the dormancy of weed seeds, solar scotches emerged weed seedlings and directly kills weed seeds by heat. Solarization with 0.05mm T Polythene sheets for 40 days is effective in controlling weeds. This is a good

	ecological and environmentally friendly method that is sustainable for small scale organic growers
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice farmers, researchers, extension workers
Approaches used in dissemination	• Farmer field and business Schools(FFBS) • Agricultural Innovation Platforms (AIP) • On-farm demonstrations and farmer field days • Training workshops • Media (Online) • Manuals, pamphlets, fact sheets
Critical/essential factors for successful promotion	• A platform for interaction of rice value chain stakeholders • Applied and adaptive research to scale use of solarization in rice cropping systems. • Promotion and training on solarization • Promotion with demos and field days for farmer groups and stakeholders on effectiveness of solarization using FFSB approach. • Training of stakeholders on biology, weed dynamics and identification of weeds in the cropping systems
Partners/stakeholders for scaling up and their respective roles	• KALRO to provide research services • County governments and MoALD to provide extension services, farmer mobilization and policy formulation • Relevant CBOs and NGOs to provide micro financing services
C: Current situation and future scaling up	
Counties where are promoted if any	None
Challenges in dissemination	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Recommendations for addressing the challenges	• Establish rice innovation platforms to facilitate interaction of rice farmers with relevant stakeholders • Train agricultural extension county officers as TOTs on use of solarization to transfer skills to farmers. • A plan for proper disposal of the polythene paper to be put in place to avoid polluting the environment.
Lessons learned	•
Social, environmental, policy and market conditions necessary	• Sensitization of communities on alternative methods of weed control and appropriate use of transparent polythene is very necessary. • Solarization control will be socially acceptable (particularly to the women who are part of the labour force in rice production) in the target communities. • Policy environment will be enabling for upscaling of the TIMP • The market will be willing and able to absorb the extra produce arising from the increased yields.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ploughing and harrowing by tractor - KES 8,000 per acre. Cost of polythene and spreading on soil is about KES 10,000 Total cost is about - KES 18,000 per acre
Estimated returns	Lowest yield unshelled is 25bags x 90kg bag @ KES 60 (lowest price) - KES 135,000 per acre depending on variety.

	Estimated returns: Income KES 135,000 - Total cost (KES 16,000) - KES 117,000 per acre.
Gender issues and concerns in development, dissemination adoption and scaling up,	• Women are the main sources of labour for this crop and solarization will enable them to use the saved weeding labour for other activities. • The technology may be too costly hindering access by women and youth who have limited access to financial resources for rice production • Women and youth have limited access to knowledge and resources to acquire the technology • Most production resources are owned by men hence limiting women and youth in acquisition and application of the technology
Gender related opportunities	• Opportunities exist for youth to provide services on solarization. • Affirmative action opportunities exist for women and youths to acquire credit to purchase the technology • Women stand to benefit from reduced workload and increased production, yields and sales.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to prejudice associated with their social status, VMGs are excluded from accessing benefits from improved technologies. • VMGs may experience delay in operations hence leading to reduced yields • Limited access to knowledge and resources to acquire the technology by VMGs • Limited access to information on the technology by VMGs
VMG related opportunities	• Affirmative action to promote solarization for the VMGs including value addition aspects • Timely operations through use of the technology will lead to enhanced production for VMGs. • Formation of groups by VMGs to access credit and services related to the technology • Increased production will lead to increased income for VMGs and thus improved livelihoods.
E: Case studies/profiles of success stories	
Success stories	Solarization successfully controls weeds in the Netherlands
Application guidelines for users	1. Josiah Marquez and Koon-Hui Wang. Soil Solarization as an Organic Pre-Emergent Weed-Management Tactic. SA-14, Dec. 2014. https://www.ctahr.hawaii.edu/oc/freepubs/pdf/SA-14.
F: **Status of TIMP Readiness (**1. Ready for up-scaling; 2. Requires validation; 3. Requires Research **)**	1. Requires validation
G: Contacts	
Contacts	Centre Director, KALRO-Kabete P.O. Box 14733-00800, Nairobi Tel:+254-0721822312 Email: cd.narl@kalro.org
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Partner organizations	KALRO, relevant NGOs, CBOs, County Governments, KEPHIS

2.10.7 Mechanical weed control in upland and lowland

2.10.7 TIMP Name	**Mechanical weed control in upland and lowland rice**
Category (i.e. technology, innovation or management practice)	Management practice   Source: land being prepared photo credit Dr. Lusike Wasilwa
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low and poor quality yields of rice due to infestation by a variety of annual and perennial weed species that compete for growth resources such as nutrients, combined with poor weed management approaches.
What is it? (TIMP description)	Mechanical weed control is a technique that controls weed populations through physical methods which remove, injure or kill. Other techniques may alter the growing environment by eliminating light, increasing the temperature of the soil, or depriving the plant of carbon dioxide or oxygen. Tools used include; hoes and slashers and implements such as tractor and motor driven ploughs and sub-soilers in order to get a weed free rice crop.
Justification	Weeds if not controlled will take over, win the competition and cause yield losses of up to 100%. Deep tillage disturbs soil and brings dormant weed seeds to the surface for germination. The fine soil allows rapid growth of weeds which can then be destroyed by mechanical weeding to get a clean crop that will give higher yields.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Agricultural extension officers, researchers, CBOs and NGOs
Approaches used in dissemination	• Farmer field and business Schools(FFBS) • Agricultural Innovation Platforms (AIP) • On-farm experimentation • Demonstrations, field days, shows • Farmer to farmer communication • Leaflets, brochures, posters
Critical/essential factors for successful promotion	• A platform for interaction of rice value chain stakeholders

	• Promotion and training of extension officers and farmers on the mechanical weeding • Promotion by training of farmer groups and stakeholders on effectiveness of timely mechanical weed control
Partners/stakeholders for scaling up and their respective roles	• KALRO to provide Research services • County governments and MoALD to provide extension services, farmer mobilization and policy formulation • Relevant CBOs and NGOs to provide micro financing services
C: Current situation and future scaling up	
Counties where are promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMP will be promoted	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Use of hoes and slasher is labour insensitive and expensive • Scarcity of hand labour (not available at peak periods) and limited cash for hiring labour • Appropriate implements such as tractors and sub-soilers are expensive and often not readily available to many in the market.
Recommendations for addressing the challenges	• Establish rice innovation platforms to facilitate interaction of farmers with relevant stakeholders. • Work with jua kali industries/sector for fabrication of appropriate implements such as sub-soilers. • Facilitate linkages with financing institution to avail credit to potential buyers of tractors and implements
Lessons learned	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field schools help in adoption of the technologies • Availability of market is essential • Partnership is important in technology dissemination and adoption. • Access and use of appropriate weeding tools will provide timely weed management with reduced labor to enhance crop production.
Social, environmental, policy and market conditions necessary	Sensitization of communities on mechanical weed management practices.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ploughing and harrowing by tractor - KES 8,000 per acre. Cost of herbicide plus spraying is about KES 6,000 Total cost is about - KES 14,000 per acre
Estimated returns	Lowest yield unshelled is 25bags x 90kg bag @ KES 60 (lowest price) - KES 135,000 per acre depending on variety. **Estimated returns:** Income KES 135,000 - Total cost (KES 16,000)

	- KES 117,000 per acre.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limited time available for other economic activities by women since they are the main sources of labour in rice production, including weeding • High cost of labour limiting effectiveness of weed control by women and youth • High cost of tractors and motorized equipment's hinders ownership by women and youth
Gender related opportunities	• Opportunities exist for males and youth males for venturing into mechanization services to farmers • Affirmative action opportunities exist for women and youths to acquire the required credit to engage labour for timely weeding and acquisition of machinery
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to prejudice associated with their social status, VMGs are excluded from accessing and benefiting from development initiatives • High cost of labour could lead to delayed weeding resulting in reduced yield among VMGs • Limited access to financial resources to engage labour during weeding and acquire machinery
VMGs related opportunities	• Formation of groups among VMGs to access training, knowledge and services related to weeding • Access to national government and several organizations who provide financial packages that support VMGs
E: Case studies/profiles of success stories	
Success stories	Proper and timely mechanical weed management has effectively managed weeds in fields in rice fields in many regions
Application guidelines for users	1. Krupnik, T.J., Naher, K. Islam, S., Hoque, M.A., Roy, A., Kumar, V., Hossain, I., Hossain, K., Shahrin, S., Gathala, M.K., Shrestha, A., Uddin, S.M.N. (2017). Integrated weed management: Experiential learning modules. Mexico, D.F. Training of Trainers Modules.
F: **Status of TIMP Readiness (**1. Ready for up-scaling; 2. Requires validation; 3. Requires Research **)**	Ready for up-scaling
G: Contacts	
Contacts	Centre Director, KALRO-Kabete P.O. Box 14733-00800, Nairobi Tel:+254-0721822312 Email: cd.narl@kalro.org
Lead organization and scientists	KALRO , Kabete Dr. Momanyi Violet and Dr. Hottensiah Mwangi
Partner organizations	KALRO, relevant NGOs, CBOs, County Governments, KEPHIS

Research Gaps

1. Innovate and validate minimum tillage implements for planting and weeding
2. Innovate and validate animal drawn row weeding implements

2.10.8 Crop rotation for weed management in upland and lowland rice

2.10.8 TIMP Name	Crop rotation for weed management in upland and lowland rice.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields and poor quality rice due to competition for growth resources such as nutrients from various annual and perennial weed species (some specific to rice) combined with poor weed management approaches.
What is it? (TIMP description)	Crop rotation is growing of different crops in succession on a piece of land to avoid exhausting the soil and to control weeds, pests and diseases specific to the crop. A good successive weed control strategy should include a crop rotation schedule for optimal rice production and yield. Major rice weeds which are proving difficult to control with current strategies, particularly in young crops include; couch grass (*Digitaria abbyssinica*), sedges (*Cyperus rotundus*), oxalis (*Oxalis latifolia*) portulaca/ purse lane (*Potulaca Oleraceae*), cleavers (*Galium aparine* L.) and white clover (*Trifolium repens* L.) among others.
Justification	There is need to have a rotation plan for rice. Land can be divided into a number of distinct areas where the crops will be rotated every 3 to 4 years. This will help to manage and prevent spread and buildup of weeds that are common to the crop. Flower yield declines to an uneconomical level in subsequent years due to accumulated effect of specific weeds that compete for nutrients if rice is left in the same field for more than three years. Cereals such as maize, wheat, oats barley or grasses such as weeping love grass, guinea grass, guatemala grass may be used for rotation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Agricultural extension officers, Agripreneurs
Approaches used in dissemination	• Farmer field and business Schools(FFBS) • Agricultural Innovation Platforms (AIP) • On-farm experimentation and dissemination, • Field days, shows, larger plot demonstrations. • Farmer to farmer communication, • Leaflets, brochures, posters
Critical/essential factors for successful promotion	• Applied and adaptive Research to upscale and release crop rotation strategies in rice cropping systems. • A platform for interaction of rice value chain stakeholders • Promotion with demos and field days for farmer groups and stakeholders on effectiveness of rotation as an effective weed management option. • Training of stakeholders on biology, weed dynamics and identification of rice weeds.

Partners/stakeholders for scaling up and their roles	• KALRO to provide research services • County governments and MoALD to provide extension services, farmer mobilization and policy formulation • Relevant CBOs and NGOs to provide micro financing services
C: Current situation and future scaling up	
Counties where technology is already being promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMPS will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Small farms due to family subdivisions • Extension staff unfamiliar with the crop rotation strategies in rice cropping systems.
Suggestions for addressing the challenges	• Establish rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Dissemination of information on the practice to farmers • Work with farmers to validate known schedules from other researchers or countries in different rice growing regions.
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the technology • Partnership is important in dissemination and adoption of this TIMP. • Use of appropriate crop rotation plan will provide timely control of weeds common and difficult to control in rice.
Social, environmental, policy and market conditions necessary	• Sensitization of communities on the crop rotation practices in weed management • Crop rotation strategies will be socially acceptable and create addition burden particularly to the women and youth who form the labour force in rice production. • The market will be willing and able to absorb the extra produce arising from the increased yields
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ploughing and harrowing by tractor - KES 8,000 per acre. Manual weeding reduced to about KES 8,000 per acre (8 casuals per day @ KES 500 for 2 weeding's). Total cost is about - KES 16,000 per acre
Estimated returns	Lowest yield unshelled is 25bags x 90kg bag @ KES 60 (lowest price) - KES 135,000 per acre depending on variety. **Estimated returns:** Income KES 135,000 - Total cost (KES 16,000) - KES 119,000 per acre.
Gender issues and concerns in development,	• Decisions on land and resource allocation in rice production often done by men and may influence the ability of women to practice crop rotation.

dissemination, adoption and scaling up	
Gender related opportunities	• Training on crop rotation including appropriate crops for rotation • Limited knowledge on high value crops to safely rotate with rice for weed management • Women stand to benefit from increased production through sale of diversified produce which will improve the household income.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to prejudice associated with their social status, VMGs are excluded from accessing benefits from improved technologies. • Limited knowledge among VMGs on high value crops to safely rotate with rice for weed management
VMGs related opportunities	• Training on crop rotation including appropriate crops for rotation • VMGs stand to benefit from increased production through sale of extra produce which will improve the household income. • Affirmative action is required to promote rotation in rice for the VMGs including value addition aspects.
E: Case studies/profiles of success stories	
Success stories	Crop rotation is practiced in Mwea irrigation scheme
Application guidelines for users	1. Charles L. Mohler and Sue Ellen Johnson (2009). The Role of Crop Rotation in Weed Management. Sustainable Agriculture Research and Education. https://www.sare.org/publications/ **2.** Krupnik, T.J., Naher, K. Islam, S., Hoque, M.A., Roy, A., Kumar, V., Hossain, I., Hossain, K., Shahrin, S., Gathala, M.K., Shrestha, A., Uddin, S.M.N. (2017). Integrated weed management: Experiential learning modules. Mexico, D.F. Training of Trainers Modules.
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	1. Ready for up-scaling
F: Contacts	
Contacts	KALRO Kabete P.O. Box 14733-00800, Nairobi Email: cdnarl@kalro.org
Lead organization and scientists	KALRO, Dr Violet Momanyi, Dr Hottensiah Mwangi
Partner organizations	KALRO, MOALD in Counties

2.11 HARVESTING AND POST-HARVEST MANAGEMENT

2.11.1 Maturity Indices

2.11.1 TIMP Name	Maturity Indices

	 Paddy panicles rice ready for harvesting (Source: Dr Sali Ndindeng – AfricaRice)  Paddy rice ready for harvesting (Source: Dr. Ruth Musila - KALRO)
Category (i.e. technology, innovation or management practice	Management Practices
A: Description of the technology, innovation or management practice	
Problem to be addressed	Paddy yield Losses due to harvesting before maturity or delayed harvesting. Harvesting before maturity results in low milling recovery, higher proportion of immature seeds, high percentage of broken rice, poor grain quality, empty pods/cylone bran and more chances of disease attack during storage of paddy while a delay in harvesting results in paddy shattering, cracking of rice in the husk and exposing the attack by insects, rodents and birds as well as lodging
What is it? (TIMP description)	This is a management practice involving correct timing of the time of harvesting paddy rice. Rice is physiologically mature when: the grains become hard, 80% of the grains have changed colour from green to straw colour, the rest of the grain are in the hard dough stage, the grains contain 20-22% moisture content, grain should be firm but not crumbly when pressed between the teeth. The ideal harvest time is 130 to 136 days after sowing for late, 113 to 125 days for medium, and 110 days for early-maturing varieties.
Justification	Harvesting before maturity or delayed harvesting results to paddy yield losses. Correct timing of the time of harvesting paddy reduces grain shattering and cracking and increases proportion of mature seeds and grain quality thus increasing paddy yields and milling recovery.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension service providers, processors, Agripreneurs
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Application of good agronomic practices to have a good crop • Participatory implementation, stakeholder capacity building and networks, creating awareness on effects of improper post-harvest handling • It is advisable to use at least 3 or more of the maturity indices to have more confidence in the harvest maturity state
Partners/stakeholders for scaling up and their roles	• Farmers – for activity implementation and promotion

	• Extension service (public and private) – technology transfer and dissemination • Agrpreneurs- outreach At ward level • Researchers (KALRO, universities) – establishment of demonstration plots, capacity building of county stakeholders, extension workers and farmers • NGOs and CBOs – upscaling of technologies • CIGs play the role of adoption of the technologies through their various groups • VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of knowledge on correct maturity indices for rice • Lack of rice innovation platforms to facilitae interaction of farmers with relevant stakeholders • Negative attitude by farmers towards adoption of new agricultural TIMPs
Suggestions for addressing the challenges	• Capacity building of farmers on appropriate harvesting indices (maturity indices) • Establish rice innovation platforms • Availing data on the economics and the gains to be made through adoption of the TIMP
Lessons learned in upscaling if any	• Farmers and stakeholders require more capacity building on maturity indices for rice
Social, environmental, policy and market conditions necessary for development and upscaling	• Farmers will be willing to adopt the TIMP • Policies targeting the empowerment of women and youth as Agripreneurs in society • Opportunities for increased returns due to proper harvesting time • Enhance outreach and partnership • The market will be able to absorb the increased harvest from adopting correct maturity indices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Reduced losses, better income and nutrition due to increase in harvest yield of the paddy rice
Gender issues and concerns in development, dissemination, adoption and scaling up	• The TIMP requires keen observation and knowledge of crop maturity which may be a challenge to illiterate men and women. • Women have limited access to education, training and extension services.
Gender related opportunities	• The TIMP increases farm income through reduction of harvest losses. • Men can capitalize on this aspect of rice production to reduce harvest losses

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Adoption of the TIMP means reduced losses, hence more rice available for consumption and sale
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Many households within Mwea in Kirinyaga County, Kenya have harvested their rice at the right maturity leading to increase in income which they have used to educate their children and also contributed to increased employment for the youth as they are the one's working at the rice entreprises.
Application guideline for users	1. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook 2. Kega, M.V. et al. (2015). Rice Cultivation Manual: Module on Harvest and post-harvest Management of Rice. KALRO/RRD Project 3. Wayua, F. O., Otipa, J. and Lusike, W. (2017). Pre-harvest Rice Management. Factsheet #, KALRO E-mimea Plant Clinics
F: Status of TIMP readiness (1-ready for upscaling;, 2- requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Centre: 0111010100
Lead organization and scientists	KALRO Wayua, F. O. and Ndambuki, J.
Partner organizations	IRRI, AfricaRice, MOALD

Research Gaps

1. Validating maturity indices of the various rice varieties / landraces
2. Quantification of the losses due to incorrect timing of the right maturity for harvesting different rice varieties

2.11.2 Tarpaulin for drying of Rice

2.11.2 TIMP Name	Tarpaulin for drying of Rice
	 **Tarpaulin for drying paddy rice (Source; Turpo)**
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Deterioration of paddy quality after harvesting due to lmproper handling and drying resulting to poor grain quality and reduced milling recovery
What is it? (TIMP description)	This is a large plastic sheet that can be laid out in the sun for drying harvested paddy rice. Make sure there are no sharp objects on the grounds that will tear the tarpaulin. Place the tarpaulin on the place you have prepared. To make the process of drying quicker, paddy grain should be placed in single layer and turned at intervals of every hour. If they are placed on a deep layer on the tarpaulin, then drying will be slower.
Justification	Paddy quality starts deteriorating after harvest depending on handling. Proper handling of harvested paddy is therefore necessary to maintain good quality grain.The tarpaulins enable efficient drying of the paddy rice to the correct moisture content of 14% thus minimizing microbial spoilage and enhancings quality and milling recovery of paddy rice.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agents, agripreneurs,
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Existence of effective extension services to demonstrate the technology • Platform for interaction of rice value chain stakeholders, strong partnership linkages • Low-cost agricultural practices are easily promoted and accepted
Partners/stakeholders for scaling up and their roles	• Extension service providers (Public and private) to help in the dissemination

	• NGOs: technology dissemination through on-farm demonstrations, capacity building of farmers, availability of tarpaulins • County governments – Help in the dissemination of the technology • Financial institutions to provide funds for acquiring the tarpaulins • CIGs play the role of adoption of the technologies through their various groups, • VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of knowledge on the technology • Lack of funds or credit facility to purchase tarpaulin
Suggestions for addressing the challenges	• Awareness creation for the technology to farmers and stakeholders • Providing funds to the farmers to purchase the technology
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Need to continue capacity building of the farmer • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	• Understanding the community culture, preferences, and practices • Market able to absorb increased supply of paddy rice
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of one tarpaulin is KES 3000/-
Estimated returns	Reduced losses, better income and nutrition (due to utilisation of saved paddy)
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth may not be able to mobilise resources needed to acquire the tarpaulin • Women have limited access to education, training and extension services. • Men dominant most decisions at the household and community levels
Gender related opportunities	• Employment opportunities exist for women and youth in sale of the tarpaulins
VMG issues and concerns in development, dissemination, adoption and scaling up	• The technology reduces post-harvest losses, hence more rice to be consumed and sold. The technology also enhances food safety by reducing microbial contamination of the rice straws during drying..
VMG related opportunities	• Opportunity for VMGs to engage in tarpaulin selling

	• Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Use of tarpaulin in drying rice straws has increased income as there are minimal losses and hence farmers at Mwea have used this to educate their children
Application guideline for users	1. Wayua F. et al. (2017). Rice post-harvest factsheet 2. Musila, R., Gichuhi, E., Menge, D., Ngari, B., Kega, V., Oyange, W., Koskei, V., Gichuru, M., Kimathi, H., Aleri, D., Mwaura, N., Mwangi, M., and Murage, A. (2022). Handbook of Paddy Rice cultivation in Mwea, Kenya. https://www.kalro.org/crops-propagation-e-books/rice-handbook 3. http://www.knowledgebank.irri.org/step-by-step-production/post-harvest/drying 4. Kega, M.V. et al. (2015), Rice Cultivation Manual: Module on Harvest and post-harvest Management of Rice. KALRO/RRD Project
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Centre: 0111010100
Lead organization and scientists	KALRO Wayua, F. O. and Ndambuki, J.
Partner organizations	IRRI, AfricaRice, MOALD

2.11.3 Motorized paddy rice threshers

2.11.3 TIMP Name	Motorised paddy rice thresher
	 **Motorised rice thresher (Source; Francis Wayua)**
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Under smallscale rice production where terrain does not allow use of combine harvesters, traditional manual threshing of rice is time intensive, labour intensive, and keeps children out of school during harvest. It also results to poor quality of paddy rice resulting in reduced milling recovery hence poor market prices.
What is it? (TIMP description)	This is a motorised rice threshing machine for separating the paddy from the straws. Rice with straws are fed into the inlet and these are threshed into paddy which are discharged from one outlet – the trash (straws) are removed in a separate outlet. Motorised paddy threshers have a outputs of 100-200 kg/hour and are ideal under upland ecology and lowland ecology where the terrain does not allow use of combine harvesters
Justification	Motorised threshers are fast and efficient, do not contaminate the threshed paddy with soil, and have minimal breakages, hence better quality. It is appropriate for smallholder farmers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agents, agripreneurs, traders, agripreneurs,
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Linking to private sector especially local artisans. • Innovative investment options for farmers and farmer groups • Developing business model/enterprise for the VMG on the use of the rice thresher • A platform for interaction of rice value chain stakeholders • Adoption of motorised threshers will be profitable if private suppliers and cooperatives buy the machine and provide services to individual or group farmers on a rental basis,

	• Existence of effective extension services to demonstrate the technology, accessibility and cost of the threshing machines by farmers • Low-cost agricultural practices are easily promoted and accepted.
Partners/stakeholders for scaling up and their roles	• Extension service providers (Public and private) to help in the dissemination • NGOs, fabrication of threshers, technology dissemination through on-farm demonstrations; capacity building of farmers • County governments –Help in the dissemination of the technology • Financial institutions – provide funds for acquiring the rice threshers
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of local availability of threshers • Lack of knowledge of the technology (lack of adequate trained operators) • Initial acquisition price of the thresher may be unaffordable to small-scale farmers
Suggestions for addressing the challenges	• Establish rice innovation platforms • Adopting public-private-partnerships, so that the private sector (e.g. NGOs) can fabricate the threshers closer to farmers; Capacity building on mechanised threshing of rice • Financial institutions to provide credit to farmers to enable acquisition of the threshers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Experiences from other rice growing areas show that adoption of mechanical threshers will be profitable if private suppliers and cooperatives buy the machine and provide services to individual or group farmers on a rental basis • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	• Farmers willing to adopt the technology • Favourable policies encouraging availability of threshers closer to rice farmers • Market able to absorb increased supply of rice
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Approximately KES 65,000/- per thresher. Then add operating costs (fuel, etc).

Estimated returns	Quality of threshed crop is highly enhanced as there is no mixing of sand, mud and soil. The motorised thresher with cleaner paddy provides significant benefits to farmers based on gains in productivity, that is higher grains recovery, improved quality and reduced labour cost
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women perform most of the production activities including threshing and winnowing • Women have limited access to education, training and extension services. • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	• Employment opportunities exist for and women in performing the operation • Employment opportunities exist for and youth in transporting the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may not be able to perform the task due to their disability • VMGs and youth have limited access credit to purchase the required implements • VMGs have less access to agricultural information, technology and Knowledge
VMG related opportunities	• Employment opportunities exist for and women in performing the operation • Employment opportunities exist for and youth in transporting the produce to the market
E: Case studies/profiles of success stories	
Success stories	Farmers from Mwea in Kirinyga County, and Mumias in Kakamega County have improved the quality of rice by use of threshers and hence they are enjoying higher income which have improved their livelihood.
Application guideline for users	1. Kega, M.V. et al. (2015). Rice Cultivation Manual: Module on Harvest and post-harvest Management of Rice. KALRO/RRD Project
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Centre: 0111010100
Lead organization and scientists	KALRO Ndambuki, J. and Wayua, F. O.
Partner organizations	Agricultural University Colleges, MOALD, NGOs, CBOs

2.11.4 Solar buble dryer

2.11.4 TIMP Name	Solar buble dryer (SBD) for rice
	
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Traditional sun drying process in which farmers spread the paddy in the open under the sun, by protecting it from animals, insects, contamination and rain lead to high losses when grains become overdried, shattered and microbial contamination.
What is it? (TIMP description)	The Solar Bubble Dryer (SBD) is the latest low-cost drying technology developed by IRRI, Hohenheim University and GrainPro. The SBD is mobile and is completely independent from fuel or the power grid, and therefore has very low operating cost. It comes in different sizes, with current models having 0.5 and 1t batch capacity
Justification	Traditional sun drying process in which farmers spread the paddy in the open under the sun, by protecting it from animals, insects, contamination and rain leads to high losses when grains become overheated, over-dried, shattered and microbial contamination. The SBD improves the traditional sun drying process as it provides a buffer for the temperature and protects the grains from overheating, compared to a mechanical dryer the SBD is more flexible, requires lower investment and does not need fuel for heating the air or running the blower.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs,, processors. Extension workers, agripreneurs
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Linking to private sector especially local artisans. • Innovative investment options for farmers and farmer groups • Developing business model/enterprise for the VMG on the use of the rice dryers • A platform for interaction of rice value chain actors, Adequate distribution of the dryers to farmers • Capacity building on the operations and maintenance
Partners/stakeholders for scaling up and their roles	• Extension service providers (Public and private) to help in the dissemination

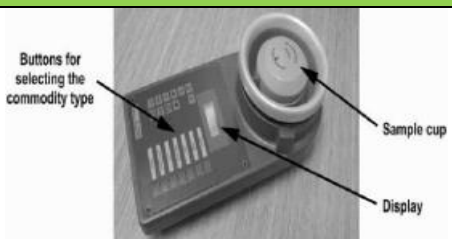
	• NGOs; fabrication of driers, technology dissemination through on farm demonstrations; capacity building of farmers, private sector, • County governments –Help in the dissemination of the technology • Financial institutions – provide funds for acquiring the driers
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Initial acquisition price of the driers may be unaffordable to small-scale farmers • Access to sufficient technical capacity for training to increase adoption
Suggestions for addressing the challenges	• Establish rice innovation platforms • Link farmers to microfinance institutions to acquire the dryers, • Sensitize county governments to support farmers • Adopting public-private-partnerships (PPP), so that the private sector (e.g. NGOs) can avail the driers closer to farmers
Lessons learned in upscaling if any	Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform. Experiences from other rice growing areas show that adoption of greenhouse driers will be profitable if private suppliers and cooperatives buy the construct a greenhouse and provide services to individual or group farmers on a rental basis. Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platform
Social, environmental, policy and market conditions necessary for development and upscaling	• Farmers willing to adopt the technology • Market able to absorb surplus rice grains
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined determined
Estimated returns	Faster, more efficient drying will increase income for farmers, allowing them to expand operations and better support their villages
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women perform most of the production activities including drying, therefore use of SBD will create more time for women to engage in other productive activities. • Women have limited access to education, training and extension services. • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	• Employment opportunities exist for and women in performing the operation • Employment opportunities exist for and youth in transporting the produce to the market

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may not be able to perform the task due to their disability • VMGs and youth have limited access credit to purchase the required implements • VMGs have less access to agricultural information, technology and knowledge
VMG related opportunities	• Employment opportunities exist for and women in performing the operation • Employment opportunities exist for and youth in transporting the produce to the market
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers at Mwea are enjoying increase in income due to drying to the right moisture content for storage
Application guideline for users	1. http://www.knowledgebank.irri.org/step-by-step-production/post-harvest/drying/mechanical-drying-systems/the-solar-bubble-dryer
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217/16 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Centre: 0111010100
Lead organization and scientists	KALRO, IRRI Wayua, F. O. and Ndambuki, J.
Partner organizations	IRRI, KALRO, MOALD

Research gaps:

Quantification of basic cost of solar dryers per one acre of rice

2.11.5 Grain moisture meter

2.7.5 TIMP Name	Grain moisture meter
	 Multipurpose grain moisture meter
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	The shortcomings of subjective approaches in determining whether rice paddy has achieved the appropriate moisture content for storage (14%) are apparent.
What is it? (TIMP description)	This is a device that is used to measure the percentage of moisture content in paddy rice
Justification	Subjective approaches in determining whether rice paddy has achieved the appropriate moisture content for storage (14%) are may not be accurate. A simple portable easy to use moisture meter enables correct moisture content measurement leading to safe paddy rice storage.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Moisture meter is expensive for individual farmers and would normally be used for farmer groups and stores which handle a lot of paddy rice • Existence of effective extension services to demonstrate the technology • Accessibility and cost of the moisture meters by farmers • Low-cost agricultural practices are easily promoted and accepted • Private ownerships is key to adoption of the moisture meters
Partners/stakeholders for scaling up and their roles	• Extension service providers (Public and private) to help in the dissemination, • NGOs, farm demonstrations; capacity building of farmers • County governments –Help in the dissemination of the technology • Financial institutions – provide funds for acquiring the moisture meters
C: Current situation and future scaling up	

Counties where already promoted if any	Tana River, Kisumu, Kirinyaga, Busia, Taita Taveta
Counties where TIMP will be up scaled	Busia, Tana-River, Garissa, Siaya, Kisumu, Homabay, Migori, Baringo, Kirinyaga, Taita-Taveta and Kwale
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Initial acquisition price of the moisture meters may be unaffordable to small-scale farmers
Suggestions for addressing the challenges	• Establish rice innovation platforms • Adopting public-private-partnerships so that the private sector (e.g. NGOs and agrovets) can avail the moisture meters closer to farmers • Provide credit to farmers to enable acquisition of the paddy moisture meters
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform. • Meters may be used routinely, for example, when paddy is delivered to a paddy store. • They are expensive for individual farmers, and would normally be used by farmers' groups and warehouses that handle a lot of paddy. • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	• Moisture meters enable accurate determination of moisture content. This will enable farmers to expand their operations and better support their villages
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 60,000/- per one motorized moisture meter
Estimated returns	Reduces losses, increase in food and nutrition security
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth may not be able to mobilise resources needed to acquire the moisture meters • Women have limited access to education, training and extension services. • Men dominant most decisions at the household and community levels
Gender related opportunities	Employment opportunities exist for women and youth in sale of the moisture meters
VMG issues and concerns in development, dissemination, adoption and scaling up	The technology reduces post-harvest losses, hence more rice can be consumed and/or sold.
VMG related opportunities	There is an opportunity for the youth and women to supply moisture meters to farmers, traders, agripreneurs, and processors
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers from rice growing regions (Kirinyaga and Kisumu) they are enjoying increase in income due to quality of the rice

Application guideline for users	1. http://www.knowledgebank.irri.org/training/fact-sheets/post-harvest-management/item/moisture-tester 2. Kega, M.V. et al. (2015). Rice Cultivation Manual: Module on Harvest and post-harvest Management of Rice. KALRO/RRD Project 3. Diack, S.B. et al. (2011). Training manual for improved rice post-harvest technologies in west Africa.
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028216/17 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Centre: 0111010100
Lead organization and scientists	KALRO Wayua, F. O. and Ndambuki, J.
Partner organizations	IRRI, MOALD

2.11.6 Subjective methods for moisture content estimation

2.11.6 TIMP Name	**Subjective methods for moisture content estimation, biting the paddy or pinching with fingers, salt method**
	 Salt method (Source; IRRI Rice Knowledge Bank)
Category (i.e. technology, innovation or management practice	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Determination of the right moisture content for harvesting and also for storage is a challenge especially if moisture meters are not available. There is need to know when the paddy is dry enough for

	safe storage, i.e. when the paddy reaches a moisture content of 14%.
What is it? (TIMP description)	Biting the paddy or pinching with fingers – Experienced farmers test the moisture content of dry paddy by biting or pinching with fingers. If the paddy is dried sufficiently for storage it will be hard and does not break easily into many parts. The Salt Method for paddy Moisture content determination is quick and easy but only indicates that paddy is above or below 15% moisture content. A mixture of dry salt and paddy is put in a glass bottle, shaken and allowed to stand for 15 minute. If the salt sticks to the sides of the bottle, forming layers, the grain moisture content is higher than the permissible 14 - 15%. Dry salt will abosrb moisture from the paddy.
Justification	While these are subjective methods for estimating the moisture content for paddy, they give fairly accurate results especially when practiced by experienced farmers. They are commonly used by smallholder farmers who cannot afford the hygrometers and / or the rice moisture meters. If after 15 minutes the salt sticks to the side of the bottle then the moisture content of the paddy is above 18% and the paddy is not safe for storage. If the salt does not stick to the bottle then the moisture content is below 18% and the paddy is safe for storage.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	Existence of effective extension services to demonstrate the technology
Partners/stakeholders for scaling up and their roles	• Extension service providers (Public and private) to help in the dissemination • NGOs, farm demonstrations; capacity building of farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Tana river and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	Establish rice innovation platforms, adopting public-private-partnerships so that the private sector (e.g. NGOs and agrovets)
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform

	• Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	The salt method is a valuable subjective method for paddy moisture estimation, easily applicable by smallholder farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of salt
Estimated returns	Reduced losses, better quality and increased income and nutrition
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels
Gender related opportunities	Youth will get income by training farmers on the subjective methods
VMG issues and concerns in development, dissemination, adoption and scaling up	The technology reduces post-harvest losses, hence more rice to be consumed and sold.
VMG related opportunities	• Opportunity for VMGs to engage in training of the subjective methods • Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Rice farmers enjoying increase in income as they are producing quality rice
Application guideline for users	1. IRRI Rice Knowledge bank 2. Diack, S.B. et al. (2011). Training manual for improved rice post-harvest technologies in west Africa.
F: Status of TIMP readiness	
(1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Centre: 0111010100
Lead organization and scientists	KALRO Wayua, F. O. and Ndambuki, J.
Partner organizations	IRRI

2.11.7 Winnowing

2.11.7 TIMP Name	Motorized Winnowing
	 Mechanical winnower (Blower) Source: Julius Munene – KALRO Mwea
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor quality rice due to contamination with impurities such as chaff, leaves, debris, soil especially if rice is harvested manually.
What is it? (TIMP description)	Harvested and dried paddy rice is winnowed to remove chaff, dust, foreign matter such as stones, shriveled, mouldy, insect damaged, rotten dis-coloured or faded, and any remaining plant parts on the grains. Winnowing is done mechanically using a mechanical blower or manually using a winnowing tray to separate the dry grain from the soil matter before sorting. Sorting should be properly done as sorted paddy attracts a better price than unsorted paddy
Justification	Paddy rice that is contaminated with straw, chaff, weed seeds, soil, rubbish, and other non-grain materials is of low value. Winnowing improves paddy quality by removing chaff, dust, foreign matter such as stones, broken grains, shriveled, and any remaining plant parts paddy. This improves the quality and longer shelf-life.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Applied and adaptive research to optimize the winnowing process, a platform for interaction of rice value chain stakeholders • Adoption of winnowing machines will be profitable if private suppliers and cooperatives buy the machine and provide services to individual or group farmers on a rental basis • Existence of effective extension services to demonstrate the technology • Accessibility and cost of the winnowing machines by farmers: low-cost agricultural practices are easily promoted and accepted

Partners/stakeholders for scaling up and their roles	• Extension service providers (Public and private) to help in the dissemination • NGOs): technology dissemination through on-farm demonstrations; capacity building of farmers • County governments –Help in the dissemination of the technology, • Financial institutions – to avail credit facilities for acquiring the winnowing machines
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Tana river and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Initial acquisition price of the winnowing machines may be unaffordable to small-scale farmers
Suggestions for addressing the challenges	• Establish rice innovation platforms • Adopting public-private-partnerships so that the private sector (e.g. NGOs and agrovets) can avail the winnower machines closer to farmers • Provide credit to farmers to enable acquisition of the paddy winnowing machines
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Extension training and regular monitoring are essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	• Farmers willing to adopt the technology • Available of the threshing and winnowing machines, and repair and maintenance service close to farmers • Market able to absorb the increased supply of rice grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Approximately KES 65,000/-
Estimated returns	Reduces losses, increase in food and nutrition security
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth may not be able to mobilise resources needed to acquire the motorized winnower • Women have limited access to education, training and extension services. • Men dominant most decisions at the household and community levels
Gender related opportunities	• Employment opportunities exist for women and youth in fabrication, sale and repair of the motorized winnowers • Employment opportunities for women and youth in sales of increased rice supply

VMG issues and concerns in development, dissemination, adoption and scaling up	• The technology reduces post-harvest losses, hence more rice to be • consumed and sold. The technology also enhances food safety by reducing aflatoxin contamination of the rice during drying.
VMG related opportunities	• Opportunity for VMGs to engage in fabrication of motorized winnowers • Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers from Mwea in Kirinyaga County have increased income due to the use of motorized threshers /winnowing machines
Application guideline for users	Diack, S.B. et al. (2011). *Training Manual For Improved Rice post-harvest Technologies in West Africa*. USAID
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Centre: 0111010100
Lead organization and scientists	KALRO
Partner organizations	MOALD

2.11.8 Hermetic storage systems

2.11.8 TIMP Name	Hermetic storage systems; bags, purdue improved crop, storage (PICs)bags, Agro-Z, grain pro

Purdue Improved Crop Storage (PICS) bags (Source; Francis Wayua

Local containers transformed to hermatic containers)

Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Post-harvest storage losses of paddy rice of up to 25% caused by fluctuation in grain moisture content and insect activity for grain stored in inappropriate storage methods.
What is it? (TIMP description)	These are airtight bags that prevent air and water from getting into the rice grain stored in them. The bags eliminate rice pests (such as weevils and larger grain borer) by depleting oxygen. The bags consist of one or two-layer envelope made of 80 µm thick high density polyethylene (HDPE) liners inserted in an outer woven polypropylene sack. The HDPE liners have low permeability to air, and are thus able to secure a modified low oxygen and high carbon dioxide atmosphere generated by respiration of the grain, insects and other life-forms enclosed when the bag Hermetic storage systems can be improvised by using locally available containers
Justification	Inappropriate storage systems predispose paddy rice to pests and disease attacks, spillage and microbial contamination resulting to losses in grain quantity and quality of up to 25%. Hermetic bags are very effective in controlling moisture content, keeping off insect pests such as weevils and also prevent microbial contamination and therefore no use of storage chemicals during storage. Moreover, grain stored in hermetic systems increases head rice recovery of stored grain by up to 10%. Farmers can reap the benefits of good grain quality thus increasing prices by delaying sales when prices are unfavouable.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	A platform for interaction of rice value chain stakeholders Presence of a functional supply chain of the hermetic bags in target areas (e.g. stocking in local agrovet shops). Training on use of the hermetic bags
Partners/stakeholders for scaling up and their roles	• Extension service providers (Public and private) to help in the dissemination • NGOs, farm demonstrations; capacity building of farmers • County governments –Help in the dissemination of the technology, • Financial institutions – provide funds for acquiring the hermetic bags • Agrodealers to stock the hermetic bags closer to farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Tana river and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru,

	Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low level of awareness of the effectiveness of the hermetic storage bags • Limited availability of the hermetic storage bags at nearest agro-dealer shops or artisans' workshops • Initial cost of purchasing the hermetic bags • National agricultural policy that guarantees affordable devices and conformity to standards is lacking.
Suggestions for addressing the challenges	• Establish rice innovation platforms • Step up promotion and demonstration especially with farmer groups • Strengthen the hermetic bags distribution networks to target farmers • Avail appropriate financing to farmers to enable acquisition of the hermetic bags • County government to subsidize initial purchase of hermetic devices. • Formulation of policy on standards to regulate production and marketing is required
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform Training on proper use is essential for optimal benefit from the hermetic storage silos • Training and extension services on harvesting techniques and good post-harvest handling practices • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation Platform
Social, environmental, policy and market conditions necessary for development and upscaling	• Farmers willing to adopt the technology • Availability of hermetic bags closer to farmers • Market able to absorb the extra grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of hermetic is 250 KES
Estimated returns	Longer paddy storage. No use of chemicals to preserve paddy hence guaranteed food safety.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth may not be able to mobilise resources needed to acquire the hermetic bags • Women have limited access to education, training and extension services. • Men dominant most decisions at the household and community levels
Gender related opportunities	• Employment opportunities exist for women and youth in sale of the hermetic bags
VMG issues and concerns in development,	• The technology reduces post-harvest losses, hence more rice to be consumed and sold. The technology also enhances food safety by reducing microbial contamination of the rice during storage

dissemination, adoption and scaling up	
VMG related opportunities	• Opportunity for VMGs to engage in hermetic bags sales • Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Rice farmers from Kisumu and Kirinyaga have increased income but the elongation of shelf life of rice and also by enabling them take their children to school
Application guideline for users	1. Musila R.N. et al. (2022). Handbook on paddy rice cultivation in Mwea. 2. Kega, M.V. et al. (2015). Rice Cultivation Manual: Module on Harvest and post-harvest Management of Rice. KALRO/RRD Project 3. Diack, S.B. et al. (2011). Training manual for improved rice post-harvest technologies in west Africa.
F: Status of TIMP readiness	
(1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Centre 0111010100
Lead organization and scientists	KALRO Wayua, F. O. and Ndambuki, J.
Partner organizations	IRRI, AfricaRice, MOALD

2.11.9 Metal Silo

2.11.9 TIMP Name	Metal Silo
	 Rice silo for small holder farmer (source; Francis Wayua)
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Use of traditional grain storage facilities such as polythene bags, cribs, improved rhombus, and brick bins are ineffective against mold and insects already present in the grain before storage. Grain stored in the traditional storage system may result to up to 25% grain loss.
What is it? (TIMP description)	A metal silo is a cylindrical structure, constructed from galvanized iron sheet (gauge No. 26 or 0.5 mm thickness) and hermetically sealed (air-tight and moisture-proof). Metal silos effectively protect stored paddy from rodents, birds and moisture that results in growth of mould in the grains. The capacity of the silos ranges from 1, 8, 12 and 1,000 90-kg bags.
Justification	Metal silos are effective in controlling rice weevils and grasshoppers without the use of pesticides such as Actellic Super and Phostoxin, hence guaranteeing food safety. Hermetic sealed metal silo (rice storage silos) can be used repeatedly thus reducing cost of buying new bags every year. They can be used for multiple crops at different times.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• To test and validate with rice farmers in the target counties • On innovative investment options for farmers and farmer groups • On cost-benefit analysis of storing rice in metal silos • A platform for interaction of rice value chain actors • Presence of a functional supply chain or fabricators of the metallic silos in target areas • Training of metal silo artisans is key for technology adoption.

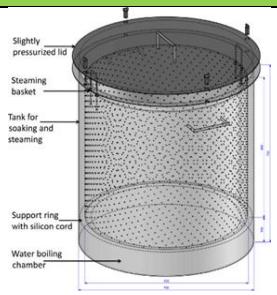
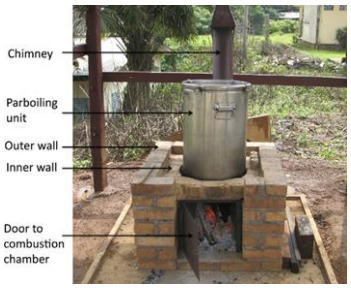
Partners/stakeholders for scaling up and their roles	• East Africa Grain Council (EAGC) • NGOs, Research organizations (KALRO, Universities); local jua kali artisans for fabrication of the metal silos
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Tana river and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low level of awareness of the effectiveness of the hermetic storage silos • Limited availability of the storage silos at nearest agrodealer shops or artisans workshops • High initial capital investment
Suggestions for addressing the challenges	• Establish rice innovation platforms • Step up promotion and demonstration especially with farmer groups • Strengthen the metal silo distribution networks to target farmers • Train youth to fabricate metal silos for the target groups and members • Avail appropriate financing to farmers to enable acquisition of the metal silos
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform. • Training on proper use is essential for optimal benefit from the hermetic storage silos. • This includes proper drying of rice before storage and how to eliminate oxygen in silo before closing it, training of metal silo artisans was key for technology adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platform
Social, environmental, policy and market conditions necessary for development and upscaling	• Farmers willing to adopt the technology • Availability of metal silos closer to farmers • Need for credit arrangement or subsidy to make the silos affordable to majority of farmers • Market able to absorb the extra grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The cost of the facilities ranges from KES 3,000 for one 90-kg bag capacity, KES 15,000 for eight bags and KES 24,000 for the 12 90-kg bags capacity among other prices.The bigger silos are popular with big institutions like schools and universities
Estimated returns	Longer rice storage. No use of chemicals. No need to purchase paddy storage bags. Silo reusable year in year out
Gender issues and concerns in development,	• Women and youth may not be able to mobilise resources needed to acquire the metal silos • Women have limited access to education, training and extension services.

dissemination, adoption and scaling up	• Men dominant most decisions at the household and community levels
Gender related opportunities	Employment opportunities exist for women and youth in fabrication, sale and repair of the metal silos
VMG issues and concerns in development, dissemination, adoption and scaling up	The technology reduces post-harvest losses, hence more rice to be consumed and sold. The technology also enhances food safety by reducing microbial contamination of the rice during storage
VMG related opportunities	• Opportunity for VMGs to engage in fabrication of metal silo • Opportunity to produce, trade in, and consume locally produced metal silo based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Metal silos in SSA were shown to be effective in controlling rice weevils without the use of pesticides such as Actellic Super and Phostoxin, the major outcome of metal silos was a change in marketing behavior: farmers sell later, at 5 months after harvest, increasing their income.
Application guideline for users	1. Diack, S.B. et al. (2011). Training manual for improved rice post-harvest technologies in west Africa.
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 – Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Centre: 0111010100
Lead organization and scientists	KALRO, Wayua, F. O. and Ndambuki, J.
Partner organizations	Agricultural University Colleges, MOALD, NGOs, CBOs

Research Gaps

- Determination of basic cost of timp per acre

2.11.10Improved parboiling technology

2.11.10 TIMP Name	**Improved parboiling technology**
Category (i.e. technology, innovation or management practice	 An improved parboiling unit made up of a tank and a steaming basket constructed using stainless steel  **An improved parboiling technology composed of an improved parboiling unit fitted directly on an improved stove made from fired bricks.** Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Post-harvest losses in quality and quantity of parboiled rice due to use of traditional parboiling units
What is it? (TIMP description)	Rice parboiling is the hydrothermal treatment of rice followed by drying before milling. It is a processing procedure in which the paddy is soaked in warm or cold water followed by steaming and drying before milling. Parboiled rice is rich in thiamine, riboflavin, niacin, calcium, phosphorous, potassium and sodium which lack in the milled white rice as they are removed during milling. Improved parboiling technology also known as Grain quality enhancer, Energy-efficient and durable Material (GEM) parboiling technology is made up of two components: an improved unit (IU) par-boiler used for soaking and steaming that is fitted on an improved stove (IS) made from fired bricks. The IU par-boiler allows for several soaking batches to be done and transferred into stand-by container. In addition, since the vessel generating the steam (tank) is different from that holding the paddy during steaming (mesh basket), several steaming batches can be done using the same water already producing steam in the tank. This makes it possible to up- scale the quantity of parboiled rice being produced and reduces water and energy wastage.
Justification	Paddy rice parboiled using the traditional parboiling technology is of low quality and quantity since it has a high percent impurities and heat-

	damaged grains, swelling and water uptake ratios, amylose content, stickiness, and cohesiveness compared to parboiled rice produced using the improved technology. The Improved technology enhances quality and quantity of milled rice and saves energy and improves significantly the physical, eating and nutritional quality of the milled rice compared to the non-parboiled counterpart. Improved parboiling technology provides an opportunity for the transformation of poor quality paddy from farmer's fields that may be due to changing climatic conditions and poor farmer- miller practices.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, entreprenuers, traders, agripreneurs,, processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days,Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	Private ownerships is key to adoption of the parboiled rice equipment
Partners/stakeholders for scaling up and their roles	• Extension service providers to help in the dissemination • NGOs, farm demonstrations; capacity building of farmers • County governments –Help in the dissemination of the technology, • Financial institutions – provide funds for acquiring the parboiled rice equipment
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Tana river and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Initial acquisition price of the parboiled may be unaffordable to small-scale farmers
Suggestions for addressing the challenges	• Establish rice innovation platforms • Adopting public-private-partnerships so that the private sector (e.g. NGOs and agrovets) can avail the improved parboilers closer to farmers • Provide credit to farmers to enable acquisition of the parboiling equipment
Lessons learned in upscaling if any	• Capacity building is crucial in upscaling • Establishment of cooperatives for rice processing
Social, environmental, policy and market conditions necessary for development and upscaling	• Farmers willing to adopt the technology • Need for credit arrangement to make parboiling equipment affordable to farmers • Market able to absorb the developed product (parboiled rice)
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 50000

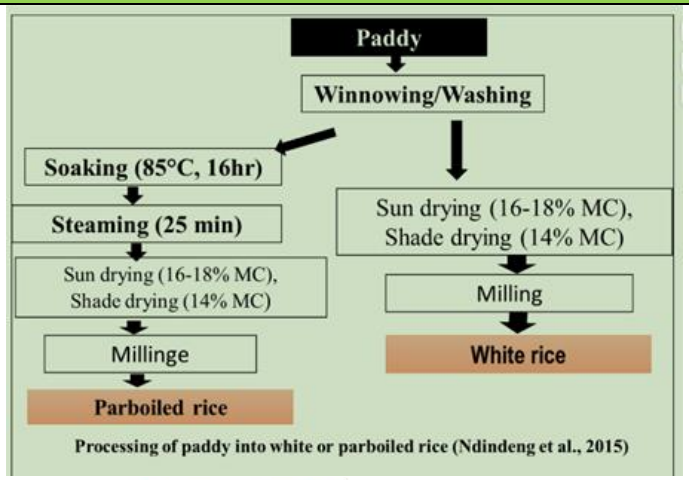
Estimated returns	Reduces losses, increases nutrient content of the parboiled rice (minerals and vitamins), enhances food security
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth may not be able to mobilise resources needed to acquire the parboiling machine • Women and youth have limited access to education, training and extension services. • Men dominatet most decisions at the household and community levels
Gender related opportunities	Employment opportunities for youth in fabricating parboiling equipment to farmers and cooperatives
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	• Opportunity for VMGs to engage in fabrication of improved parboiling unit • Opportunity to produce, trade in, and consume nutritious locally produced rice based products. Parboiled rice is rich in vitamins and nutrients
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guideline for users	1. Ndindeng S. A., Manful J., Futakuchi K., Mapiemfu-Lamare D., Akoa-Etoa J.M., Tang E.N.,Bigoga J, Graham-Acquaah S and Moreira J (2015). Upgrading the quality of Africa ' s rice: a novel artisanal parboiling technology for rice processors in sub- Saharan Africa *Food Science & Nutrition* published by Wiley Periodicals, Inc. https://www.researchgate.net/publication/276306831
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	Require further research
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Wayua, F. O. and Ndambuki, J.
Partner organizations	AfricaRice, IRRI

Research Gaps

- Validation of the parboiled equipment to different rice varieties

2.12 RICE NUTRITION AND VALUE ADDITION

2.12.1 Parboiled rice

2.12.1 TIMP Name	Parboiled rice
	 Processing of paddy into white or parboiled rice (Ndindeng et al., 2015)  Source: Dr Sali Ndindeng – AfricaRice
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Losses due to breakage during milling, low nutrition value in rice (thiamine, riboflavin, niacin or nicotinic acid and mineral such as calcium, phosphorus, potassium, sodium) for the milled white rice and short shelf life of the milled white rice
What is it? (TIMP description)	Rice parboiling is the hydrothermal treatment of rice followed by drying before milling. It is a processing procedure in which the paddy is soaked in warm or cold water followed by steaming and drying before milling. Parboiled rice is rich in thiamine, riboflavin, niacin, calcium, phosphorous, potassium and sodium which lack in the milled white rice as they are removed during milling.
Justification	Milled white rice is low in nutrients as bran which is rich in thiamine, riboflavin, niacin or nicotinic acid and minerals such as calcium, phosphorus, potassium, sodium has been removed by the milling and polishing. Being a more nutritive (higher amounts of Vitamin B1, and water soluble minerals) rice product compared to white rice and that it shows lower human glycemic index makes parboiled rice best bet product to address issues of low nutritive value in rice. Moreover compared to milled white rice, parboiled rice would be more preferred for managing diebetes and preventing diseases like Beriberi which is a deficiency of thiamine (Vitamin B1).

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farrmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards • Validate and test recipes on parboiled rice
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on processing parboiled rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of parboiled rice • KEBs- Standard formulation of parboiled rice • Supermarkets and institutions to provide market for the parboiled rice • Financial institutions to provide support to agripreneurs to establish cottages for parboiled rice
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Busia and Tana river
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for parboiled rice and linking farmers to credit facility providers to get capital to engage in parboiled rice agribusiness
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Parboiled rice will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb parboiled rice as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined

Estimated returns	Enhanced nutrition status from consumption of parboiled rice
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of processing parboiled rice, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption is not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guideline for users	1. Ndindeng et al. (2015). Upgrading the quality of Africa's rice: A novel artisanal parboiling technology for rice processors in sub-Saharan Africa 2. http://www.knowledgebank.irri.org/step-by-step-production/post-harvest/milling/milling-and-quality/item/parboiling 3. Wayua F. et al. (2017). Rice parboiled factsheets
F: Status of TIMP readiness	
(1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1- Requires further research
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	AfricaRice, IRRI, MOALD,

2.12.2 Brown rice

2.12.2 TIMP Name	Brown rice
	 Source:James Ndambuki
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value of milled white rice, as it has the bran and germ removed which are the most nutritious parts of the rice grain, and therefore this leaves white rice with very few essential nutrients.
What is it? (TIMP description)	Brown rice is a whole rice grain and contains all parts of the rice grain including the fibrous bran, the nutritious germ, and the carb-rich endosperm. It takes a while to cook due to its tough bran exterior. It is produced by removing hull or husk portion only. Brown rice is rich in phosphorous, magnesium, thiamin, selenium, manganese, niacin and vitamin B6 which miss in the milled white rice as they are removed during milling.
Justification	Milled white rice is of low nutrition value compared to brown rice. Being a rice product that contains the germ and bran layers that are rich in nutrients such as vitamins (niacin and Vitamin B6), dietary fiber and minerals (phosphorous, magnesium, thiamin, selenium, manganese) makes brown rice a good bet to be promoted to address the issue of low nutrition value found in white rice. Moreover, the dietary fibers prevent gastro intestinal disease, the vitamins prevent diseases like beriberi and the minerals prevent high blood pressure.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, households, traders, agripreneurs,, processors
Approaches used in dissemination	Agricultural shows and exhibitions, On-farm visits, Digital platforms (Apps websites social media), Mass media (electronic and print), Farmer Trainings, Farmer to farmer trainings, Publications (Brochures, factsheets, pamphlets, manuals, posters), On-farm demonstrations Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards, • Validate and test recipes on brown rice
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on processing canned rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of canned rice, • KEBs- Standard formulation of canned rice

	• Supermarkets and institutions to provide market for the canned rice • Financial institutions to provide support to agripreneurs to establish cottages
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Establishing rice innovation platforms • Working with KEBS to develop standards for brown rice and linking farmers to credit facility providers to get capital to engage in brown rice agribusiness
Lessons learned in upscaling if any	Capacity building of farmers and stakeholders is important for adoption of brown rice technology
Social, environmental, policy and market conditions necessary for development and upscaling	• Brown rice will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb brown rice as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of brown rice. Brown rice is rich in phosphorous, magnesium, thiamin, selenium, manganese, niacin and vitamin B6 which miss in the milled white rice as they are removed during milling.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers • Men dominate most decisions at the household and community levels
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awarenes
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of brown rice
Application guideline for users	1. http://www.knowledgebank.irri.org/training/fact-sheets/post-harvest-management/item/brown-rice-fact-sheets 2. Wayua F. et al. (2017). Brown Rice factsheets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1-Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	IRRI, Agricultural University Colleges, MOALD, NGOs, CBOs

2.12.3 Popped rice

2.12.3 TIMP Name	Popped rice
	 Source:Francis Wayua
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Milled white rice is of low nutrition value in terms of fiber, minerals and vitamins since it lacks the hull and bran.
What is it? (TIMP description)	Popped rice is a value added product where the hull or the bran is intact and is made from heating rice in a pan containing salt until they pop. Popped rice is rich in fibers, vitamins and minerals which miss in the milled white rice. Popped rice is used as a snack.
Justification	Milled white rice is low in nutrients as bran which is rich in thiamine, riboflavin, niacin or nicotinic acid and minerals such as calcium, phosphorus, potassium, sodium has been removed by the milling and polishing. Being rich in vitamins, minerals and dietary fibers makes popped rice a product to be promoted to address issue of low nutritive value in white rice. Moreover, consumption of popped rice prevents constipation and helps in digestion. Diversification of rice products will increase rice consumption and increase dietary nutrients in rice.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, households, traders, agripreneurs, and processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards • Validate and test recipes on parboiled rice
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on processing popped rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide backstopping on dissemination of popped rice, • KEBs- Standard formulation of popped rice

	• Supermarkets and institutions to provide market for the popped rice • Financial institutions to provide support to agripreneurs to establish cottages for popped rice.
C: Current situation and future scaling up	
Counties where already promoted if any	Tana river, Kisumu, Kirinyaga, Kisumu and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for popped rice • Linking farmers to credit facility providers to get capital to engage in popped rice agribusiness
Lessons learned in upscaling if any	• Popped rice is a high quality product which can be processed at household level
Social, environmental, policy and market conditions necessary for development and upscaling	• Popped rice will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb popped rice as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	• Not yet determined
Estimated returns	• Enhanced nutrition status from consumption of popped rice
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of processing popped rice, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption is not in favour of the innovation
Gender related opportunities	• Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities

	• There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced popped rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of popped rice
Application guideline for users	Wayua F. et al. (2017). Popped Rice factsheets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	Agricultural University Colleges, MOALD, NGOs, CBOs

2.12.4 Germinated Brown Rice

2.12.4 TIMP Name	**Germinated Brown Rice**
	 Source: https://en.wikipedia.org/wiki/Germinated_brown_rice
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutritive value in white rice because the removal of the bran and germ also during milling lead to a dramatic loss of many important nutrients that are essential to a balanced diet
Justification	Milled white rice is low in nutrients as bran which is rich in thiamine, riboflavin, niacin or nicotinic acid and minerals such as calcium, phosphorus, potassium, sodium has been removed by the

	milling and polishing. Being more nutritive rich since it neutralizes the phytic acid, releasing the proteins, vitamins, and enzymes allowing these important nutrients to be absorbed during digestion, makes germinated brown rice best bet value added product to address issues of low nutritive value in rice. Moreover it ameliorates the hyperglycemia, boosts the immune system, lowers blood pressure, inhibits development of cancer cells and assists the treatment of anxiety disorders.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks, • Availability of quality standards • Validate and test recipes on germinated brown rice
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on germinated brown rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination ofTIMP • KEBs- Standard formulation of germinated brown rice • Financial institutions to provide support to agripreneurs to establish cottages for germinated brown rice
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Tana river, Kisumu and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for germinated brown rice • Linking farmers to credit facility providers to get capital to engage in germinated brown rice agribusiness

Lessons learned in upscaling if any	Germinated brown rice is a high quality product which can be made at the household level
Social, environmental, policy and market conditions necessary for development and upscaling	• Germinated brown rice will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb parboiled rice as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of germinated brown rice
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of processing parboiled rice, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption is not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice-based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions Kenya are currently earning their livelihoods from the processing and sale of germinated brown rice
Application guideline for users	1. Wu F. et al. (2013). Germinated Brown Rice and Its Role in Human Health. Critical Reviews in Food Science and Nutrition, 53:451–463 2. Wayua F. et al (2017). Germinated brown rice factsheets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	Require validation
G: Contacts	

Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O
Partner organizations	IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

Research gap

- Validation of cost analysis of germinated brown rice

2.12.5 Fortified Rice

2.12.5 TIMP Name	**Fortified Rice**
	
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	To alleviate micronutrient (Iron, zinc, and Iodine), and Vitamin A deficiencies which are high among populations that consume rice as staple food
What is it? (TIMP description)	This is polished rice enriched with minerals and vitamins (Vitamin A, B, iron, zinc, and iodine). This is done by first to produce the fortified kernels and then blend them with regular, polished rice.
Justification	Milled white rice is a poor source of vitamins and micronutrients Fortified rice with micronutrient (Iron, Iodine, Vitamin A and zinc) is the best bet value added product, cost-effective and has great potential to increase the daily intake of essential vitamins and minerals for the general population consuming rice as staple food thereby addressing widespread micronutrient deficiencies in Kenya
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, households, traders, agripreneurs, and processors

Approaches used in dissemination	Farrmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on fortified rice
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on fortification of rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of fortified rice, • KEBs- Standard formulation of fortified rice • Supermarkets and institutions to provide market for fortified rice • Financial institutions to provide support to agripreneurs to establish cottages for fortified rice
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Tana River and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for fortified rice and linking farmers to credit facility providers to get capital to engage in fortified rice agribusiness
Lessons learned in upscaling if any	Fortified rice is a quality product which can be processed at household level
Social, environmental, policy and market conditions necessary for development and upscaling	• Fortified rice will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb fortified rice as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of fortified rice

Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of processing fortified rice, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awarenes
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of fortified rice
Application guideline for users	1. Wayua F. et al. (2017). Fortification of rice leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Require validation
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO; Ndambuki, J., and Wayua, F. O.
Partner organizations	IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

Research Gaps

- Validation to optimize the fortification of rice for the mentioned vitamins and micronutrients

2.12.6 Rice Papad

2.12.6 TIMP Name	Rice Papad
	 Rice papad (Source; Sagma et al)
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value in white rice and limited value added products
What is it? (TIMP description)	Papad rice is a product made from combination of legumes, fruits and rice. This enriches rice with protein, vitamins and minerals.
Justification	Milled white rice is of low nutritive value. Compare to ordinary white rice papad is enriched with protein, vitamins and minerals making it the best bet value added product for reduction of micronutrient deficiencies such as protein energy malnutrition especially among the population consuming high amounts of white rice.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farrmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on papad rice
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on papad rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of papad rice
C: Current situation and future scaling up	
Counties where already promoted if any	Kiriyaga, Kisumu,Tana river and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot

Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for papad rice and linking farmers to credit facility providers to get capital to engage in papad rice agribusiness
Lessons learned in upscaling if any	Papad rice is a quality product which can be produced at household level
Social, environmental, policy and market conditions necessary for development and upscaling	• Farmers willing to adopt the technolgy • Papad rice will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb papad rice as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced consumption of the highly nutritious papad rice
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of processing papad rice, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awarenes
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of papad rice

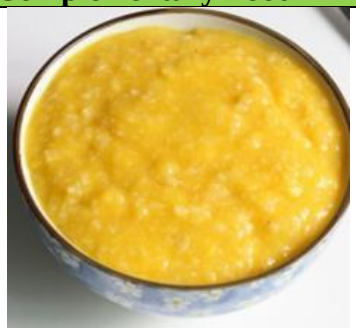
Application guideline for users	1. Wayua et al. (2017). Papad rice leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2- requires validation; 3-requires further research**)**	1- Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO. Ndambuki, J., and Wayua, F. O.
Partner organizations	IRRI, AfricaRice, KEBS, Agricultural University Colleges, MOALD, NGOs, CBOs

Research gap

Innovative methods to combine various ingredients in the papad rice

Gross margins and economic returns of processing papad rice

2.12.7 Rice and Legume Complemntary Food

2.12.7 TIMP Name	**Rice and Legume Complementary Food**
	 **Weaning food (Source; Sagma et al)**
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value in milled white rice
What is it? (TIMP description)	This is a complementary food made from rice and legume (e.g. chick pea) for feeding babies from 6 months while breastfeeding. Complementary foods are foods for breastfeeding babies from six (6) months to complement the breast milk in providing needed nutrients to the growing baby.

Justification	Blending of rice with legume flour improves the nutrient content of rice-based complementary foods. This helps prevent childhood malnutrition in rice growing areas. Plain porridge prepared from rice flour and water practiced in some rice growing areas as complementary foods for children is not sufficiently rich in energy and lacks protein and essential vitamins, such as A and C. It is therefore important to add legumes, such as protein-rich cowpeas, chickpea, beans or pigeon peas.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, households, traders, agripreneurs, and processors
Approaches used in dissemination	On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, Training workshops and agricultural innovation platforms, social media (facebook, twitter), digital platforms (mobile apps, TV shows)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing
Partners/stakeholders for scaling up and their roles	• Farmers to provide land for establishment of small scale processing for complementary food • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of complementary food preparation • KEBs- Standard formulation of complementary food food • Supermarkets and institutions to provide market for the complementary food • Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Tana river, Kilifi, Kirinyaga, Kisumu, Busia, Kakamega and Siaya
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Creation of awareness about the product to the government agencies farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Establishing rice innovation platforms • Working with KEBS to develop standards for complementary food and linking farmers to credit facility providers to get capital to engage in weaning food agribusiness
Lessons learned in upscaling if any	None
• Social, environmental, policy and market conditions necessary for development and upscaling	• Target women in society who are the major adopters and child care givers • Target youth as Agripreneurs in processing the rice-based complementary foods. • Enabling policy encouraging production and consumption of rice-legume complementary foods for chidlren

	• Provide market information on volume, quality and supply consistency requirement
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	• Enhanced child nutrition status from consumption of complementary food • Savings from treating malnutrition deficiencies. The savings in health costs can be invested in other family activities.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women usually perform the task of complementary feeding of children • Women and youths usually perform the task of processing complementary foods. Consequently the technology may not be adopted if women are already over whelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guideline for users	1. Rice Cultivation Manual: Module on Harvest and post-harvest Management of Rice 2. KALRO/RRD Project
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1- Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217

	The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org
Lead organization and scientists	KALRO Ndambuki, J. and Wayua, F. O
Partner organizations	Agricultural University Colleges, MOALD, NGOs, CBOs
Research gaps 1. Research on the best rice varieties for blending with legumes to prepare the complementary foods 2. Validation of ratios for optimum combination of rice and legumes during formulation of the complementary foods 3. Basic cost of processing the rice-legume based complementary foods	

2.12.8 Rice cookies

2.12.8 TIMP Name	**Rice cookies**
	 **Whole rice cookies (Source: Dr. Ruth Musila)**
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value in white rice products
What is it? (TIMP description)	Whole rice cookies are made from whole rice, cooking oil and salt. Its commonly served as snack
Justification	Milled white rice is of low nutritive value and since rice cookies are made from whole grain rice which is rich in minerals and vitamins, this makes rice cookies best bet rice value added product for increased nutrition among people consuming rice as a staple food.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and processors
Approaches used in dissemination	Farrmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters,

	leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on rice cookies
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on rice cookies • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of theTIMP, • KEBs- Standard formulation of rice cookies • Supermarkets and institutions to provide market for the rice cookies • Financial institutions to provide support to agripreneurs to establish cottages for rice cookies
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for whole rice cookies and linking farmers to credit facility providers to get capital to engage in whole rice cookies agribusiness
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Rice cookies will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb rice cookies as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of whole rice cookies
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of baking rice cookies, the innovation may not be adopted if women are already overwhelmed with other chores

	• Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of rice cookies
Application guideline for users	1. Wayua F. et al. 2017. Whole rice cookies food leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

Research gaps

1.Optimizing processing procedures for rice cookies

2. Cost-benefit analysis of rice cookies processing

2.12.9 Rice crackies

2.12.9 TIMP Name	Rice crackies
	 **(Source; Kega et al)**
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value in milled white rice Limited value added products from rice in the market
What is it? (TIMP description)	Whole rice crackies are made from whole rice flour, wheat flour, cooking oil and salt. Its commonly served as snack.
Justification	Milled white rice is of low nutritive value and since rice crackies are made from whole grain rice which is rich in minerals and vitamins, this makes rice crackies best bet rice value added product for increased nutrition among people consuming rice as a staple food.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on rice crackies
Partners/stakeholders for scaling up and their roles	• Farmers to provide land for establishment of small scale processing for whole rice crackies • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of whole rice crackies production • KEBs- Standard formulation of whole rice crackies • Supermarkets and institutions to provide market for the whole rice crackies • Financial institutions to provide support to Agripreneurs.

C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers, • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for whole rice crackies • Linking farmers to credit facility providers to get capital to engage in whole rice crackies agribusiness
Lessons learned in upscaling if any	Rice crackies is a high quality product which can be processed using low-cost methods for smallholder household income generation.
Social, environmental, policy and market conditions necessary for development and upscaling	• Rice crackies will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb rice crackies as supply increases
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from increased consumption of whole rice crackies
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of rice crackies, the innovation may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of rice crackies
Application guideline for users	Wayua F. et al 2017. Whole rice crackies leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

2.12.10 Rice cake

2.12.10 TIMP Name	**Rice cake**
	 **Rice Cake (Source; Kega et al)**

Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutritional value in milled white rice flour Limited products made from rice in the market
What is it? (TIMP description)	Rice cake is a snack made from rice flour and wheat mixed in the ratio of 1:1 respectively. Sugar, margarine and baking powder are added to the mixture and mixed with eggs, water or milk to make a smooth free flowing paste. The paste is poured onto a well greased baking pan and baked in a hot oven (190 °C) for 1 hour and 20 minutes or until golden brown. Blending of rice with wheat flour improves the nutrient content of rice.
Justification	Milled white rice flour is of low nutritive value, rice cake is enriched with protein such as eggs and milk making it best bet valued added product for increasing the nutritive value of white rice flour and for diversification of rice products in the market to spur production and consumption.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards • Validate and test recipes on parboiled rice
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on baking rice cakes • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice cakes • KEBs- Standard formulation of rice cakes • Supermarkets and institutions to provide market for rice cakes • Financial institutions to provide support to agripreneurs to establish cottages for rice cakes
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders

	• Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice cakes • Linking farmers to credit facility providers to get capital to engage in rice cakes agribusiness
Lessons learned in upscaling if any	Yet to be documented
Social, environmental, policy and market conditions necessary for development and upscaling	• Rice cakes will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb rice cake as supply increases
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of rice cake
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of baking rice cake, , the innovation may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice region in Kenya are currently earning their livelihoods from the processing and sale of rice cakes
Application guideline for users	1. Wayua F. et al. 2017. Rice cake leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	

Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

2.12.11 Instant rice flour

2.11.11 TIMP Name	**Instant rice flour**
	 **Instant rice flour (Source; Kega et al)**
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value in milled white rice flour Post-harvest losses of rice during milling Limited products from broken rice
What is it? (TIMP description)	Instant rice flour is made from broken rice, fortifying ingredients and water. Its commonly served as snack. It is used in processing baked, frying and boiled products.
Justification	Milled white rice flour is of low nutritive value, instant rice flour is enriched with minerals, vitamins and protein making it best bet valued added product to increase the nutritive value of rice flour and for diversification of rice products in the market to spur production and consumption. Moreover, utilization of the broken rice for instant rice flour reduces losses which occur on rice during drying and milling.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural

	shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on instant rice flour
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on processing instant rice flour • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of instant rice flour • KEBs- Standard formulation of instant rice flour • Supermarkets and institutions to provide market for instant rice flour • Financial institutions to provide support to agripreneurs to establish cottages for instant rice flour
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for instant rice flour and linking farmers to credit facility providers to get capital to engage in instant rice flour agribusiness
Lessons learned in upscaling if any	Capacity building is crucial for instant rice flour processing
Social, environmental, policy and market conditions necessary for development and upscaling	• Instant rice flour will be socially acceptable particularly for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb instant rice flour as supply increases
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined determined
Estimated returns	Enhanced nutrition status from consumption of instant rice flour

Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of processing instant rice flour, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	• Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of instant rice flour
Application guideline for users	Wayua F. et al. 2017. Instant rice flour leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Require validation
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

GAPs

1. Optimising instant rice flour production processes
2. Providing data on gross margins and market demand for instant rice production

2.12.12 Rice flour

2.12.12 TIMP Name	Rice flour
	 Rice flour (Source; Kega et al)
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutritional value of milled white rice Limited value added products in the market
What is it? (TIMP description)	Rice flour is made from milling rice to flour. Its used to process various food products including boiled, fried and baked products.
Justification	Milling of rice grain to flour provides a avenue of blending which improves the nutrition components of the product. This also increases diversification of products as several value added products can be made from it. This also spurs up employment opportunities and income.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on rice flour
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on uses of rice flour • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of uses of rice flour • KEBs- Standard formulation of rice flour • Supermarkets and institutions to provide market for the rice flour • Financial institutions to provide support to agripreneurs to establish cottages for usin rice flour in various recipes

C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice flour and linking farmers to credit facility providers to get capital to engage in rice flour agribusiness
Lessons learned in upscaling if any	Awareness creation and capacity building of rice flour millers to produce a product which meets the established specifications
Social, environmental, policy and market conditions necessary for development and upscaling	• Rice flour will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb rice flour as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of rice flour
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of processing and using rice flour, the innovation may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths to engage in rice flour processing and sale, as a product with commercial potential, just like other flours.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness

VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of rice flour
Application guideline for users	Wayua et al. 2017. Rice flour leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J. and Wayua, F. O
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

2.12.13 Rice Bread

2.12.13 TIMP Name	Rice Bread
	 **Rice bread (Source; Dr. Ruth Musila)**

Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutritional value in milled white rice Limited rice value added products in the market
What is it? (TIMP description)	Rice bread is a bread made from blending rice whole flour and wheat flour. Its used as a snack.
Justification	Milled white rice flour is of low nutritive value, rice bread is made from whole rice flour and is enriched with protein such as eggs and milk making it best bet valued added product for increasing nutritive value of white rice flour and for diversification of rice products in the market to spur production and consumption.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on rice bread
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on baking of rice bread • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice bread • KEBs- Standard formulation of rice bread • Supermarkets and institutions to provide market for rice bread • Financial institutions to provide support to agripreneurs to establish cottages for baking rice bread
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale,

	Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice bread • Linking farmers to credit facility providers to get capital to engage in rice bread agribusiness
Lessons learned in upscaling if any	Capacity building is crucial on how to bake rice bread
Social, environmental, policy and market conditions necessary for development and upscaling	• Rice bread will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb rice bread as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of rice bread
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of baking rice bread, the innovation may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption is not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths to engage in rice bread baking and sale
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of rice bread

Application guideline for users	Wayua F. et al. 2010. Rice bread leaflet
F: Status of TIMP readiness (1- ready for upscaling;, 2- requires validation; 3-requires further research**)**	1- Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

2.12.14 Rice mandazi

2.12.14 TIMP Name	**Rice mandazi**
	 Rice Mandazi (Source; James Ndambuki)
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value of white milled rice Limited rice value added products in the market
What is it? (TIMP description)	Rice mandazi is a snack made from whole rice flour and wheat mixed in the ratio of 1:1 respectively. Milk is added to the mixture to make a dough which is rolled into 1 cm thickness and cut into desired shapes. These are then deep fried in hot oil until golden brown.
Justification	Milled white rice flour is of low nutritive value, rice mandazi is made from whole rice flour and may be enriched with protein such as eggs and milk making it best bet valued added product for increasing nutritive value of white rice flour and for diversification of rice products in the market to spur production and consumption.

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on rice mandazi
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on processing rice mandazi • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice mandazi • KEBs- Standard formulation of rice mandazi • Supermarkets and institutions to provide market for the rice mandazi • Financial institutions to provide support to agripreneurs to establish cottages for rice manadzi
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Tana river, Kisumu and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice mandazi • Linking farmers to credit facility providers to get capital to engage in rice mandazi agribusiness
Lessons learned in upscaling if any	• Rice mandazi is a quality product which can be prepared at the household level
Social, environmental, policy and market conditions necessary for development and upscaling	• Rice mandazi will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb rice mandazi as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of rice mandazi

Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making rice mandazi, the innovation may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youth in rural areas
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awarenes
VMG related opportunities	The innovation will: • Help VMGs to earn a living • Enable VMG s maximize on availability of enterprises to engage in small cottage industries
E: Case studies/profiles of success stories	
Success stories from previous similar projects	CBOs who adopted rice mandazi processing technology have had sustained source of income and improved livelihood
Application guideline for users	Wayua et al. 2017. Rice mandazi leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

2.12.15 Parched rice

2.12.15 TIMP Name	**Parched rice**

	 **Parched Rice (Source; Sagma et al)**
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value in milled white rice Limited rice value added products in the market
What is it? (TIMP description)	This is a product made from pre heating the paddy rice in pan which then swells and bursts to a white product. This product is consumed as snack
Justification	Milled white rice is low in nutrients as bran which is rich in thiamine, riboflavin, niacin or nicotinic acid and minerals such as calcium, phosphorus, potassium, sodium has been removed by the milling and polishing. Being a rich in niacin, Vitamin D, calcium, fibre, iron, thiamine and riboflavin makes parched rice a value added product to be promoted to address issue of low nutritive value in white rice. Moreover, consumption of parched rice prevents constipation and helps in digestion. Diversification of rice products will increase rice consumption and increase dietary nutrients in rice.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on parched rice
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on making parched rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of parched rice • KEBs- Standard formulation of parched rice • Supermarkets and institutions to provide market for parched rice • Financial institutions to provide support to Agripreneurs to establish cottages for parched rice
C: Current situation and future scaling up	

Counties where already promoted if any	Kirinyaga, Tana River, Kisumu and Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for parched rice • Linking farmers to credit facility providers to get capital to engage in parched rice agribusiness
Lessons learned in upscaling if any	Capacity building is key in adoption of parched rice
Social, environmental, policy and market conditions necessary for development and upscaling	• Parched rice will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb parched rice as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined determined
Estimated returns	Enhanced nutrition status from consumption of parched rice
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making parched rice, the innovation may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youth in rural areas
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, innovations, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	The innovation will help: • VMGs to earn a living • VMG maximize on availability of enterprises to engage in small cottage industries
E: Case studies/profiles of success stories	

Success stories from previous similar projects	CBOs who adopted rice processing technology have had sustained source of income and improved livelihoods
Application guideline for users	Wayua et al 2017. Parched rice leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 – Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J. and Wayua, F. O
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

GAP

- Determination of basic cost of parched rice processing

2.12.16 Puffed rice

2.12.16 TIMP Name	**Puffed rice**
	 Puffed rice (Source; Sagma et al)
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value from milled white rice Limited rice value added products in the market
What is it? (TIMP description)	Puffed rice refers to pre-gelatinized rice grains (either by being parboiled, boiled, or soaked) that are puffed by the rapid expansion of steam upon cooking. Puffed rice retains the shape of the rice grain, but is much larger. Puffed rice is rich in minerals, vitamins and antioxidants

Justification	Milled white rice is low in nutrients as bran which is rich in thiamine, riboflavin, niacin or nicotinic acid and minerals such as calcium, phosphorus, potassium, sodium has been removed by the milling and polishing. Being a rich in vitamins, minerals and antioxidants makes puffed rice a value added product to be promoted to address issue of low nutritive value in white rice. Moreover, consumption of puffed rice is good for the heart more so for people suffering from high blood pressure. Diversification of rice products will increase rice consumption and increase dietary nutrients in rice.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on puffed rice
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on making puffed rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of puffed rice, • KEBs- Standard formulation of puffed rice • Supermarkets and institutions to provide market for puffed rice • Financial institutions to provide support to agripreneurs to establish cottages for puffed rice
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	Limited awareness of the technology by farmers, lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders, lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for puffed rice • Linking farmers to credit facility providers to get capital to engage in puffed rice agribusiness
Lessons learned in upscaling if any	Awareness creation and capacity building of puffed rice cottages to produce a product which meets the established specifications

Social, environmental, policy and market conditions necessary for development and upscaling	• Puffed rice will be socially acceptable particularly for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb puffed rice as supply increases
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of puffed rice
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making puffed rice, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths to engage in puffed rice processing and sale, as a product with commercial potential.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of puffed rice
Application guideline for users	Wayua et al. 2017. Puffed rice leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi

	Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO Ndambuki, J., and Wayua, F. O.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

2.12.17 Rice noodles

2.12.17 TIMP Name	Rice noodles
	 **(Source; Sagma et al)**
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value in rice Limited rice value added differentiated products in the market
What is it? (TIMP description)	Noodles are a type of food made from unleavened dough which is either rolled flat and cut, stretched, or extruded, into long strips or strings. Rice noodles are noodles made with whole rice flour and water as the principal ingredients. Sometimes ingredients such as tapioca or corn starch are added in order to improve the transparency or increase the gelatinous and chewy texture of the noodles. Addition of vitamins and minerals improve the nutritive value.They are also rich in fiber.
Justification	Milled white rice is low in nutrients. Being rich in vitamins, minerals and dietary fibers makes rice noodles a product to be promoted to address issue of low nutritive value in white rice. Moreover, consumption of rice noodles prevents constipation and helps in digestion as it is rich in fiber. Diversification of rice products will increase rice consumption and increase dietary nutrients in rice.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, Training workshops and agricultural innovation platforms, social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards • Validate and test recipes on parboiled rice
Partners/stakeholders for scaling up and their roles	• Farmers to provide land for establishment of small scale processing for rice noodles • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice noodles production • KEBs- Standard formulation of rice noodles • Supermarkets and institutions to provide market for the rice noodles,

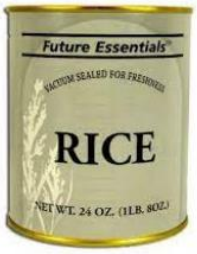
	• Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice noodles • Linking farmers to credit facility providers to get capital to engage in rice noodles agribusiness
Lessons learned in upscaling if any	Awareness creation and capacity building of rice noodles to produce a product which meets the established specifications; and enforcing these specifications.
Social, environmental, policy and market conditions necessary for development and upscaling	• Rice noodles will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb rice noodles as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined determined
Estimated returns	Enhanced nutrition status from consumption of rice noodles
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making rice noodles the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths to engage in rice noodles processing and sale, as a product with commercial potential
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services

	• Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions in Kenya are currently earning their livelihoods from the processing and sale of rice noodles.
Application guideline for users	Wayua et al. 2017. Rice noodles leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 – Ready for upscling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO, Ndambuki, J. and Wayua, F. O.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

GAPS

1. Noodle fortification
2. Determination of basic cost of rice noodles production

2.12.18 Canned rice

2.12.18 TIMP Name	**Canned rice**
	 Canned rice, (**Source: Sagma et al.)**

Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited value added products for rice in the market and short shelf life of milled white rice.
What is it? (TIMP description)	Canned rice is a vacuum packed rice. It contains about 150 g of rice (1 cup). Canned rice can be preserved for a long time and will not lose the nutrition, taste or flavor. It is delicious unwashed rice that is easy to prepare.
Justification	Milled white rice has a short shelf life, Canned rice can stay for long and also preserves the nutrients and taste making it best bet valued added product for preservation of milled rice for longer periods without loosing it original nutritive vale and taste.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farrmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	Stakeholder capacity building and networks, availability of quality standards for small scale processing
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on processing canned rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of canned rice • KEBs- Standard formulation of canned rice • Supermarkets and institutions to provide market for the canned rice` • Financial institutions to provide support to agripreneurs to establish cottage industries
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu
Counties where TIMP will be up scaled	Tana river, Kilifi, Kirinyaga, Kisumu, Busia and Siaya
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for canned rice

	• Linking farmers to credit facility providers to get capital to engage in canned rice agribusiness
Lessons learned in upscaling if any	Their need of adhering to the KEBs regulations
Social, environmental, policy and market conditions necessary for development and upscaling	• Canned rice will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb canned rice as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of canned rice
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of processing canned rice, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths to engage in canned rice processing and sale, as a product with commercial potential
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Cooperatives from Mwea are really enjoying increased income by use of the canning technology hence improvement for their livelihood and nutrition
Application guideline for users	Wayua et al. 2017. Canned rice leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	2 - Require validation
G: Contacts	

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Lead organization and scientists	KALRO
Partner organizations	Agricultural University Colleges, MOALD, NGOs, CBOs

GAPS

1. Determination of basic cost of canned rice production

2.12.19 Flaked rice

2.12.19 TIMP Name	**Flaked rice**
	Flaked rice (Source; Sagma et al.) 
Category (i.e. technology, innovation or management practice	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited rice value added products in the market and low nutrition value in white rice
What is it? (TIMP description)	Flaked rice is a type of rice dish made from raw, toasted, or parboiled rice grains pounded into flat flakes. They are eaten as is, toasted, fried, or used as ingredients or toppings for other dishes. Depending on their use, they can be crispy, crunchy, chewy, or soft in texture with a light nutty flavor.
Justification	Milled white rice is low in nutrients. Being rich nutrients and in dietary fibers especially when made from whole grain flour of parboiled rice, makes flaked rice a value added product to be promoted to address issue of low nutritive value in white rice. Moreover, consumption of flaked rice prevents constipation and helps in digestion as it is rich in fiber. Diversification of rice products will increase rice consumption and increase dietary nutrients in rice.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farrmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and

	posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing
Partners/stakeholders for scaling up and their roles	• Farmers to provide land for establishment of small scale processing for flaked rice • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of flaked rice production • KEBs- Standard formulation of flaked rice • Supermarkets and institutions to provide market for the flaked rice • Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms, creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for flaked rice • Linking farmers to credit facility providers to get capital to engage in flaked rice agribusiness
Lessons learned in upscaling if any	Practical trainings are very important in upscaling flaked rice product
Social, environmental, policy and market conditions necessary for development and upscaling	• Target women and youth as Agripreneurs in society who are the major adopters (manufacturers) and consumers, respectively. • Enabling policy and policy review from time to time. • Increase Public-Private dialogue to agree on a model that will ensure compliance with international standards. • Provide market information on volume, quality and supply consistency requirement
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of flaked rice
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youths usually perform the task of rice processing. The technology is likely to be adopted by youth who are more likely to have snacks • Women have limited access to education, training and extension services

	• Men dominate most decisions at the household and community levels
Gender related opportunities	Employment opportunities exist for women and youths to engage in flaked rice processing and sale, as a product with commercial potential
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awarenes
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in rice growing regions Kenya are currently earning their livelihoods from the processing and sale of flaked rice.
Application guideline for users	Wayua et al 2017. Flaked rice leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center: 0111010100
Lead organization and scientists	KALRO
Partner organizations	Agricultural University Colleges, MOALD, NGOs, CBOs

2.12.20 Rice bran oil

2.12.20 TIMP Name	**Rice bran oil**
	 Rice bran oil (Source; Sagma et al)
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	

Problem to be addressed	Limited value added products for rice in the market and low nutrition value in rice
What is it? (TIMP description)	Rice bran oil is oil oil extracted from the hard outer brown layer of rice called bran. It is known for its high smoke point of 232 °C and mild flavor, making it suitable for high-temperature cooking methods such as stir frying and deep frying.
Justification	Rice bran oil is rich in protein, fat, ash, crude fiber, vitamin B, E, antioxidants and higher proportions of heart-healthy unsaturated fat. This nutrients makes it the best bet value added rice product in improving blood cholesterol levels which decreases risk of heart diseases and type II diabetes. In addition, value addition of rice increases production and utilization, as well as incomes within the rice value chain..
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, leaflets, Training workshops, mass media, digital platforms/social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing • Validate and test recipes on rice bran oil
Partners/stakeholders for scaling up and their roles	• County government to mobilize farmers to be trained on processing rice bran oil • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice bran oil • KEBs- Standard formulation of rice bran oil • Supermarkets and institutions to provide market for the rice bran oil
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Busia
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms, creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice bran oil • Linking farmers to credit facility providers to get capital to engage in rice bran oil agribusiness

Lessons learned in upscaling if any	Capacity building is important for adoption of rice bran oil technology
Social, environmental, policy and market conditions necessary for development and upscaling	• Rice bran oil will be socially acceptable particulary for women and youth as major consumers and targeted agripreneurs • Policy environment will be enabling for upscaling of the TIMP • Public-Private dialogue to agree on a model that will ensure compliance with international standards. • There will be willing consumers to absorb rice bran oil as supply increase
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of rice bran oil
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of processing rice bran oil, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption is not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths to engage in rice bran oil processing and sale, as a product with commercial potential.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Cooperatives at Mwea who are doing rice bran oil processing have increased income and hence livelihood improvement
Application guideline for users	Wayua et al. 2017. Rice bran oil leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Require validation
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 KALRO Call Center: 0111010100
Lead organization and scientists	KALRO, Ndambuki, J., and Wayua, F. O.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

GAPS

1. Validation of basic machines for producing the rice bran oil
2. Determination of basic cost for rice bran oil processing

2.12.21 Rice beer

2.12.21 TIMP Name	Rice beer
	 **Rice beer (Source; Sengar et al)**
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low nutrition value in rice Limited rice value added products in the market
What is it? (TIMP description)	Rice beer is an alcoholic drink made from yeast-fermented rice grains.
Justification	Diversification of rice value added products increases production and consumption of rice products. Rice beer provides an alterntive variety amongst alcoholic drinks.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, Training workshops and agricultural innovation platforms, social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing
Partners/stakeholders for scaling up and their roles	• Farmers to provide infrastructure for establishment of small scale processing for rice beer • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice beer production • KEBs- Standard formulation of rice beer • Supermarkets and institutions to provide market for the rice beer • Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities

Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice beer • Linking farmers to credit facility providers to get capital to engage in rice beer agribusiness
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Target women and youth as Agripreneurs in society who are the major adopters (manufacturers) and consumers, respectively. • Enabling policy and policy review from time to time. • Increase Public-Private dialogue to agree on a model that will ensure compliance with international standards. • Provide market information on volume, quality and supply consistency requirement
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Enhanced nutrition status from consumption of rice beer
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making rice beer, the technology may constrain labour availability in the rice value chain, if women are already overwhelmed with other chores • Women have limited access to education, training and extension services • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	• Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in the rice growing regions are currently earning their livelihoods from the processing and sale of rice beer
Application guideline for users	Wayua et al. 2017. Rice beer leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2- requires validation; 3-requires further research**)**	2 - Require validation
G: Contacts	

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Lead organization and scientists	KALRO KALRO Call Center: 0111010100
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MOALD, NGOs, CBOs

GAPs

1. Determination of basic cost for production of rice beer
2. Determination of nutrient content of rice beer

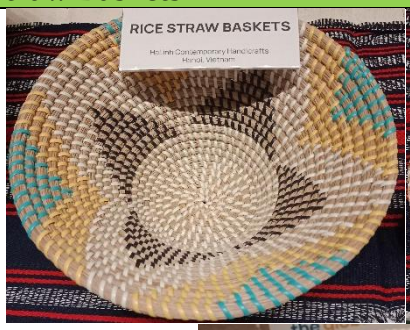
2.12.22Rice Straw bales

2.12.22 TIMP Name	**Rice Straw bales**
	 **Rice Straw bale (Source: Dr. Lusike Wasilwa)**
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of rice straws Seasonality of fodder production
What is it? (TIMP description)	Rice bales are grouping of rice straws packaged and bundled together.
Justification	Burninig of rice straws pose environmental dangers and processing into baskets minimizes this dangers. Processing of rice straws into bales creates a cottage industry hence source of employment and income generation. Due the seasonality of fodder production and rice straw is

	available throughout the year. This is due to the fact that most rice production is under irrigation schemes. This makes rice straw as an alternative for livestock feeds. Also its nutrition can be improved by blending with urea.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, Training workshops and agricultural innovation platforms, social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing
Partners/stakeholders for scaling up and their roles	• Farmers to provide land for establishment of small scale processing for rice straw bales • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice straw bail production • Livestock Institutions and Farmers to provide market for the rice straw bales • Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice straw bales • Linking farmers to credit facility providers to get capital to engage in rice straw bales agribusiness
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Target women and youth as Agripreneurs in society who are the major adopters (manufacturers) and consumers, respectively. • Enabling policy and policy review from time to time. • Increase Public-Private dialogue to agree on a model that will ensure compliance with international standards. • Provide market information on volume, quality and supply consistency requirement
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined

Estimated returns	Income from sale of the product
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making rice straw bales, the technology may not be adopted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may negatively affect adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce and trade in locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in the rice growing regions are currently earning their livelihoods from the processing and sale of rice straw bales
Application guideline for users	Kega et al. 2015. Rice Cultivation Manual
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center – 0111010100
Lead organization and scientists	KALRO KALRO Call Center: 0111010100
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MoALFC, NGOs, CBOs

2.12.23Rice Straw Baskets

2.12.23 TIMP Name	Rice Straw Baskets
	   **Rice Straw Basket (Photo source; Dr. Ruth Musila)**
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of rice straws
What is it? (TIMP description)	Baskets made from dried rice straws
Justification	Burninig of rice straws pose environmental dangers and processing into baskets minimizes these dangers. Processing of rice straws into baskets creates a cottage industry hence source of employment and income generation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, Training workshops and agricultural innovation platforms, social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing
Partners/stakeholders for scaling up and their roles	• Farmers to provide land for establishment of small scale processing for rice straw baskets • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice straw basket production • KEBs- Provide standards for rice straw basket

	• Supermarkets and institutions to provide market for the rice straw baskets • Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice straw basket • Linking farmers to credit facility providers to get capital to engage in rice straw basket agribusiness
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Target women and youth as Agripreneurs in society who are the major adopters (manufacturers) and consumers, respectively. • Enabling policy and policy review from time to time. • Increase Public-Private dialogue to agree on a model that will ensure compliance with international standards. • Provide market information on volume, quality and supply consistency requirement
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Income from sale of the product
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making rice straw baskets, the technology uptake may be negatively affected if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce and trade in locally produced rice

	based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in the rice growing regions are currently earning their livelihoods from the processing and sale of rice straw basket
Application guideline for users	Wayua et al. 2017. Rice straw baskets leaflets
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	Require validation
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center – 0111010100
Lead organization and scientists	KALRO: Ndambuki J.M.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MoALFC, NGOs, CBOs

GAPs

- Determination of basic cost for production of rice straw basket

2.12.24Rice Straw Pot

2.12.24 TIMP Name	**Rice Straw Pot**
	 **Rice Straw Pot (Photo source; Dr. Ruth Musila)**

Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of rice straws
What is it? (TIMP description)	Pot made from dried rice straws
Justification	Burninig of rice straws pose environmental dangers and processing into pots minimizes these dangers. Processing of rice straws into pots creates a cottage industry hence source of employment and income generation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, Training workshops and agricultural innovation platforms, social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing
Partners/stakeholders for scaling up and their roles	• Farmers to provide land/facility for establishment of small scale processing for rice straw pots • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice straw pot production • KEBs- Provide standards for rice straw pot • Supermarkets and institutions to provide market for the rice straw pots • Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice straw pots • Linking farmers to credit facility providers to get capital to engage in rice straw pots agribusiness

Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Target women and youth as Agripreneurs in society who are the major adopters (manufacturers) and consumers, respectively. • Enabling policy and policy review from time to time. • Increase Public-Private dialogue to agree on a model that will ensure compliance with international standards. • Provide market information on volume, quality and supply consistency requirement
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Income from sale of the product
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making rice straw pots, the technology uptake and scaling may be negatively affected if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce and trade in locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in the rice growing regions are currently earning their livelihoods from the processing and sale of rice straw pots
Application guideline for users	Kega et al. 2014. Rice, Annual Report RDA/ KOPIA/KARI
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	Require validation
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org

	KALRO Call Center – 0111010100
Lead organization and scientists	KALRO: Ndambuki J.M.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MoALFC, NGOs, CBOs

Gaps

- Determination of basic cost of rice straw pot production

2.12.25Rice Straw Broom

2.12.25 TIMP Name	**Rice Straw Broom**
	 **Rice Straw Broom (Source; Kinka NYC)**
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of rice straws
What is it? (TIMP description)	Broom made from dried rice straws
Justification	Burninig of rice straws pose environmental dangers and processing into brooms minimizes this dangers. Processing of rice straws into brooms creates a cottage industry hence source of employment and income generation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, Training workshops and agricultural innovation platforms, social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing

Partners/stakeholders for scaling up and their roles	• Farmers to provide land for establishment of small scale processing for rice straw brooms • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice straw broom production • KEBs- Provide standards for rice straw broom • Supermarkets and institutions to provide market for the rice straw broom • Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice straw brooms • Linking farmers to credit facility providers to get capital to engage in rice straw broom agribusiness
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Target women and youth as Agripreneurs in society who are the major adopters (manufacturers) and consumers, respectively. • Enabling policy and policy review from time to time. • Increase Public-Private dialogue to agree on a model that will ensure compliance with international standards. • Provide market information on volume, quality and supply consistency requirement
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Income from sale of the product
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making rice straw brooms, the technology adoption may be negatively affected if women if the two groups are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce and trade in locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in the rice growing regions are currently earning their livelihoods from the processing and sale of rice straw brooms
Application guideline for users	1. Wayua et al. 2017. Rice straw brooms leaflets 2. Kega et al. 2014. Rice, Annual Report RDA/ KOPIA/KARI
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center – 0111010100
Lead organization and scientists	KALRO: Ndambuki J.M.
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MoALFC, NGOs, CBOs

2.12.26Rice Husk Briquette

2.12.26 TIMP Name	**Rice Husk Briquette**
6	 **(a) Open air carbonizers**

	  **(b) Rice husk briquette machines (c) Rice Husk Briquette (Source; Vincent Kega)**
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of rice husks Losses of husks due to dehulling rice
What is it? (TIMP description)	Briquette made from dried rice husks
Justification	High wastes after dehulling of rice. The handling of this rice husk is mostly by burning. The smoke from burning is toxic, which impacts to the environment negatively. Briquette processing is one of the ways of reducing this dangers. Processing of rice husks into briquettes creates a cottage industry hence source of employment and income generation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, Training workshops and agricultural innovation platforms, social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing
Partners/stakeholders for scaling up and their roles	• Farmers to provide land/infrastructure for establishment of small scale processing for rice husk briquettes • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice straw briquette production • KEBs- Provide standards for rice husk briquette • Supermarkets and institutions to provide market for the rice husk briquette • Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot

Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice husk briquettes • Linking farmers to credit facility providers to get capital to engage in rice straw briquette agribusiness
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Target women and youth as Agripreneurs in society who are the major adopters (manufacturers) and consumers, respectively. • Enabling policy and policy review from time to time. • Increase Public-Private dialogue to agree on a model that will ensure compliance with international standards. • Provide market information on volume, quality and supply consistency requirement
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Income from sale of the product
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making rice husk briquette, their productivity in other chores they do will be negatively affected, which in turn may lower the adoption of this technology. • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce and trade in locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmer groups and individuals in the rice growing regions are currently earning their livelihoods from the processing and sale of rice husk briquettess

Application guideline for users	1. Kega et al. 2014. Rice, Annual Report RDA/ KOPIA/KARI
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	Require validation
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi Email: cd.fcrc@kalro.org KALRO Call Center – 0111010100
Lead organization and scientists	KALRO KALRO Call Center: 0111010100
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MoALFC, NGOs, CBOs

Gaps

1. Determination of basic cost for rice husk briquette production
2. Fabrication of low-cost rice husk briquette making machines

2.12.27Rice Husk Particle Board

2.12.27 TIMP Name	**Rice Husk Particle Board**
	 **Rice Husk Particle Board (Source; Vincent Kega)**
Category (i.e. technology, innovation or management practice	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of rice husks

What is it? (TIMP description)	The rice husk from milling is winnowed and wind-sifted and then coated with synthetic resin adhesive in specially designed adhesive applicators. The coated husk is spread as an even mat on support molds & consolidated under heat and pressure in a hydraulic hot press. The hot pressed panels are cooled and trimmed to the desired dimension and the resultant product is a rice husk particle board.
Justification	High wastes after dehulling of rice. The handling of this rice husk is mostly by burning. The smoke from burning is toxic leading a negative impact to the environment. Particle board processing is one of the ways of reducing this dangers. Processing of rice husks into particle board creates a cottage industry hence source of employment and income generation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs, and Processors
Approaches used in dissemination	Farmer field and business school (FFBS), Agricultural innovation platform (AIP), On farm demonstrations, field days, Agricultural shows and exhibitions, promotional materials;brochures and posters, Training workshops and agricultural innovation platforms, social media (facebook, twitter)
Critical/essential factors for successful promotion	• Stakeholder capacity building and networks • Availability of quality standards for small scale processing
Partners/stakeholders for scaling up and their roles	• Farmers to provide land for establishment of small scale processing for rice husk particle board • Extension service providers to help in dissemination • KALRO-to train trainers of trainers and provide back stopping on dissemination of rice husk particle board production • KEBs- Provide standards for rice husk particle board • Supermarkets and institutions to provide market for the rice husk particle board • Financial institutions to provide support to Agripreneurs.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Challenges in dissemination	• Limited awareness of the technology by farmers • Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of standards and credit facilities
Suggestions for addressing the challenges	• Establishing rice innovation platforms • Creation of awareness about the product to the government agencies, farmers, traders, agripreneurs, and processors. • Capacity building the farmers on processing of the products. • Working with KEBS to develop standards for rice husk particle board • Linking farmers to credit facility providers to get capital to engage in rice husk particle board agribusiness

Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	• Target women and youth as Agripreneurs in society who are the major adopters (manufacturers) and consumers, respectively. • Enabling policy and policy review from time to time. • Increase Public-Private dialogue to agree on a model that will ensure compliance with international standards. • Provide market information on volume, quality and supply consistency requirement
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Income from sale of the product
Gender issues and concerns in development, dissemination, adoption and scaling up	• If women and youths perform the task of making rice husk particle board, the technology adoption may be negatively impacted if women are already overwhelmed with other chores • Women have limited access to education, training and extension services. • Men dominate most decisions at the household and community levels and may prevent adoption if not in favour of the innovation
Gender related opportunities	Employment opportunities exist for women and youths who usually perform this task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce and trade in locally produced rice based products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guideline for users	1. Kega et al. 2014. Rice, Annual Report RDA/ KOPIA/KARI
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	2. Requires validation
G: Contacts	
Contacts	The Centre Director, KALRO-Mwea Industrial Crop Research Centre; P.O. Box 298-10300, Kerugoya. Email: Kalro.Mwea@kalro.org., Tel. +254 0202028217 The Centre Director, KALRO-FCRC Muguga P.O. Box 30148-00100.Nairobi

	Email: cd.fcrc@kalro.org KALRO Call Center – 0111010100
Lead organization and scientists	KALRO KALRO Call Center: 0111010100
Partner organizations	KEBS, IRRI, AfricaRice, Agricultural University Colleges, MoALFC, NGOs, CBOs

Gap

- Determination of basic cost of rice husk particle board production

2.13 MECHANIZATION OF RICE PRODUCTION ACTIVITIES

2.13.1 A Power Tiller (walking tractor)

2.13.1 TIMP Name	**A Power Tiller (walking tractor)**
Category (i.e. technology, innovation or management practice)	Technology   
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Low production due to inadequate and unreliable manual labour and drudgery, leading to inappropriate land preparation and other field operations. • Low productivity unavailability of machinery for small and irregular paddy fields.
What is it? (TIMP description	A Power Tiller (walking tractor) is a single axle agricultural machine used for various farm operations. The machine operator walks behind in the direction of travel while controlling it during field operations. Some have provision for a seat for the operator. Attachments may include equipment for land preparation, weeding, spraying, a pump among other equipment. Can be used for both irrigated and upland ecology rice production. It is user friendly, affordable and can access areas where larger 4-wheeled tractors may not.

Justification	The labour intensity and laboriousness of rice production in Kenya is major challenge to improved productivity. This is a challenge that can be overcome by the introduction and application of mechanization of field operations such as land preparation. The power tiller is a good and feasible mechanization as it is also adaptable being attached to different implements and other attachments such as trailers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Machine Operators, Mechanization service providers, Financial institutions, Researchers, Academia
Approaches used in dissemination	• On farm and field demonstrations • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, poste • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Training of machine operators, involvement of machinery manufacturers, • Availing reliable and durable machinery and equipment. • Quick accessibility of spare parts • Well trained technical staff to conduct trainings for operators, machinery service providers and other stake holders • Sensitizing farmers and service providers on other attachments to the power tiller.
Partners/stakeholders for scaling up and their roles	• KALRO-technical support and training • Rice Promotion Programme (RIPP) at the State department of Agriculture; Technical support • Regional Agricultural Technology Development Centres - ATDC's – provide training and demonstration venues • Existing farmer groups and cooperatives – to mobilise farmers for upscaling activities • CaDPERP, AMS's and other government supported projects, NGO's – provide extension services • Financial institutions – credit for purchase of equipment
C: Current situation and future scaling up	
Counties where already promoted if any	Not yet promoted in Rice
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• Few women and youth may be willing to take up service provision • Inadequate number of technical trainers • Inadequate number of Machine Operators of 2 wheel

	• Farm tractors may not prefer the power tiller due to the energy requirement during operation. • High cost of Reliable and durable machinery
Social, environmental, policy and market conditions necessary for development and upscaling	• Infrastructure challenges may not attract women and youth to venture and operate the power tiller. • Some canals are too wide for machinery to cross and may be risky for both experienced and inexperienced gender • Women and youth will contribute positively in promoting water saving technologies with the changing climatic conditions • Most of the power tiller field operations are done mainly by men hence the need to capacity build them • Implementation of National Agricultural Mechanization Policy 2021 developed by the ministry of agriculture will enhance uptake of mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic cost – Power tiller and related implements	Varies with models and country of origin
Estimated returns	Not yet determined
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and some youth may not be able to operate the tiller. • Women and youth have limited access to finances for procurement of quality machinery compared to men • Very few women and youth have adequate technical training on operating power tiller • On job machinery operation training does not favour women and youth
Gender related opportunities	• Formation of groups to procure the machinery, with more youth as members • National government and several organizations have financial packages to support women, youth and vulnerable persons • Youth
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to finances to purchase farm machinery. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services. • Due to prejudices associated with their social status, VMGs are excluded from access to and benefits from improved technologies. • Most implements may not be easily accessible and/or usable by VMGs
VMG related opportunities	• Tax exemptions for VMGs • Link VMGs with youth groups who can offer the service • Organizations and NGO's willing to support VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	The TIMP has been promoted by RiceMAPP project during introduction of mechanization in 2012

Application guidelines for users	Currently under preparation by KALRO and CaDPERP
F: Status of TIMP readiness (1- ready for upscaling;, 2-requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo House, P.O. Box 30028 – 00100, NAIROBI, E-mail: info@kilimo.go.ke. Telephone: +254-20-2718870 Hotline: 0800724891
Lead organization and scientists	KALRO, MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP County governments, KiliMOL Ltd

2.13.2 Rubber tracked crawler tractor

2.14.2 TIMP Name	**Rubber tracked crawler tractor**
Category (i.e. technology, innovation or management practice)	**Technology**  Wheeled tractor stuck in a field Boggy  Track-tractor with boggy field rubber tracks better traction
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Low production due to low field efficiency in land preparation in boggy fields
What is it? (TIMP description)	This is tractor with rubber tracks that enables it maneuver easily in difficult terrain especially boggy and slippery ground.
Justification	Low production due to low field efficiency in land preparation in boggy fields is a challenge to improving productivity of rice, especially under flooded rice production systems. Boggy fields are

	difficult to access and operate in using the regular wheeled machinery. However, tracked tractors are able to access and operate in such fields. This can enable the utilization of such difficult areas for flooded rice production.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Machine Operators, Mechanization service providers, Financial institutions, Researchers, Academia
Approaches used in dissemination	• On farm and field demonstrations • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, poste • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Well trained technical staff to conduct trainings for operators, machinery service providers and other stake holders • Involvement/sensitization of machinery entrepreneurs on the need to procure appropriate machinery considering certain desirable characteristics to meet certain criteria best suited to the desired tasks. • Availing reliable and durable machinery and equipment. • Ease of accessing of spare parts
Partners/stakeholders for scaling up and their roles	• KALRO-technical support and training • Rice Promotion Programme – RIPP at the State department of Agriculture; Technical support • Regional Agricultural Technology Development Centres - ATDC's – provide training and demonstration venues • Existing farmer groups and cooperatives – to mobilise farmers for upscaling activities • CaDPERP, AMS's and other government supported projects, NGO's – provide extension services • Financial institutions – credit for purchase of equipment
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga county
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• Inadequate number of technical trainers • Poor infrastructure in some irrigation schemes • Inadequate financial resources for dissemination activities
Suggestions for addressing the challenges	• Involving financial institutions when introducing or promoting technologies • National and county governments to facilitate staff training

Lessons learned in upscaling if any	• Most machinery service providers and entrepreneurs do not consult relevant technical bodies for machinery specifications for suitability among other technical aspects. • Perceived preference to certain models even before performance validation by relevant bodies.
Social, environmental, policy and market conditions necessary for development and upscaling	• Infrastructure challenges may not attract women and youth to venture and operate the tract-tractor. • Some canals are too wide for machinery to cross and may be risky for both experienced and inexperienced gender • Women and youth will contribute positively in promoting water saving technologies with the changing climatic conditions • Implementation of National Agricultural Mechanization Policy 2021 developed by the ministry of agriculture will enhance uptake of mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Varies with models and country of origin – KES.1.8M to 2.8M
Estimated returns	Not yet determined
Gender issues and concerns in development ,dissemination, adoption and scaling up	• Relatively new technology recently introduced in Mwea and in Kenya hence low awareness among women and youth • Initially women and youth may not have access to finances for procurement of the machinery compared to men. • Very few women and youth have adequate technical training • On job machinery operation training does not favour women and youth
Gender related opportunities	• Formation of farmer or youth groups to procure the machinery and/or provide the service • National government and several organizations have financial packages to support women, youth and vulnerable persons
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to finances to purchase farm machinery. • VMGs may have limited awareness and access to the technology • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services. • Due to prejudices associated with their social status, VMGs are excluded from access to and benefits from improved technologies.
VMG related opportunities	• Tax exemptions for the VMG to enhance access • Formation of groups among VMGs to enhance access to the technology • Organizations and NGO's willing to support VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Technology is relatively new but is successful in Mwea Irrigation Scheme
Application guidelines for users	To be developed by AES/regional ATDC's and Rice Promotion Programme -RIPP

F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research**)**	1 - Ready for upscaling
G: Contacts	
Contacts	Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo House, P.O. Box 30028 – 00100, NAIROBI, E-mail: info@kilimo.go.ke. Telephone: +254-20-2718870 Hotline: 0800724891
Lead organization and scientists	KALRO, MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP County governments, KiliMOL Ltd

2.13.3 Upland ecology Disc and chain Harrows

2.14.3 TIMP Name	**Upland ecology Disc and chain Harrows**
Category (i.e. technology, innovation or management practice)	 Disc Harrow  Chain Harrow for levelling
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity due to unsuitable soil tilth in upland rice production

What is it? (TIMP description)	These are equipment that break soil clods into smaller pieces after ploughing.
Justification	Unsuitable or poor soil tilth, leads to poor germination and plant establishment and thus low productivity, particularly in upland rice. Harrows are implements designed to break up large soil clods into smaller clods resulting on better seed and soil contact. This leads to better seed germination and improved crop establishment and consequently higher productivity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Machine Operators, farmers, Mechanization service providers, Financial institutions, Researchers, Academia
Approaches used in dissemination	• Shows, Field days and exhibitions • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, posters • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Involve stakeholders in the agricultural mechanization sector to ensure availability and accessibility of machinery, land for trials and demonstrations. • Existing farmer groups and SACCO's. • Involve farmer groups in dissemination • County and Central government support for policy formulation.
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services ATDC's, - trainings, demonstrations including workshop fabrications • CaDPERP and KALRO - collaboration with ATDC's for trials sites • Farmers/farmer groups- offer and co-manage trials sites • National and County governments - support in extension • Agricultural extension agents, agripreneurs, (Formal and informal) for policy, awareness and dissemination • Kenya School of Agriculture - training of relevant personnel • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot

Challenges in dissemination	• The implements may not be readily available • Inadequate funds for dissemination activities • Inadequate extension staff
Suggestions for addressing the challenges	• National and county governments to facilitate staff availability and training • Introduce e extension
Lessons learned in upscaling if any	None. Will be a new technology for upland/rainfed rice production
Social, environmental, policy and market conditions necessary for development and upscaling	• Technology suitable for minimum tillage in areas where upland rice ecology practiced • Environment e.g. terrain, will be suitable for the application of the technology • Policy on increased production of rice in upland ecology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES.500,000/- for disc harrow and approximately KES.250,000/- for the chain harrow
Estimated returns	Yet to be determined
Gender issues and concerns in development, dissemination, adoption and scaling up dissemination	• Relatively new technology recently introduced in Mwea and in Kenya • Women and youth may not have access to finances for procurement of the machinery compared to men. • Very few women and youth have adequate technical training on operation of the machinery • On job machinery operation training does not favour women and youth
Gender related opportunities	• Formation of farmer or youth groups to procure the machinery • National government and several organizations have financial packages to support women, youth and vulnerable persons
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to finances to purchase farm machinery. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services. • Due to prejudices associated with their social status, VMGs are excluded from access to and benefits from improved technologies
VMG related opportunities	• Tax exemptions • Support group formation of VMGs to easily access the technology • Organizations and NGO's willing to support VMGs • National government and several organizations have financial packages to support women, youth and vulnerable persons
E: Case studies/profiles of success stories	
Success stories	None for upland rice ecology

Application guidelines for users	• To be developed by AES/regional ATDC's and Rice Promotion Programme (RIPP)
F: Status of TIMP readiness (1-ready for upscaling 2-requires validation; 3-requires further research**)**	Requires validation
G: Contacts	
Contacts	Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo House, P.O. Box 30028 – 00100, NAIROBI, E-mail: info@kilimo.go.ke. Telephone: +254-20-2718870 Hotline: 0800724891 KALRO Call Centre 254 0111010100
Lead organization and Scientists	KALRO, MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP County governments, KiliMOL Ltd

2.13.4 Combined Chisel plough & Power Harrow

2.12.4 TIMP Name	**Combined Chisel plough & Power Harrow for Alternative land preparation (WSRC)**
Category (technology, innovation or management practice)	 Three operations i.e. Chisel ploughing, flash flooding, rotavation achievable in a single day. Transplanting is possible on the same day too Combined chisel plough and power harrow
A: Description of the technology, innovation or management practice	
Problem to be addressed	• High water use in rice fields in readiness for rotavation • Reduced productivity due to delayed planting as a result of delayed field preparation.
What is it? (TIMP description)	This is the employment of two equipment, the Chisel plough & Power Harrow in succession and less water to prepare the land for rice planting in flooded rice production.
Justification	• Land preparation for irrigated rice possible in less than 2 days (possible to chisel plough 45min~flood 3hrs ~rotavate 45min ~ transplant 45min/acre in a single day)

	• Reduce number of days for flooding paddy fields especially in Mwea where two main crops will be possible after completion of Thiba dam • Address the issue of Climate change by use of less water during rotavation
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers growing rice, Machine Operators, Mechanization service providers, Financial institutions, Researchers, Academia
Approaches used in dissemination	• Shows, Field days and exhibitions • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, posters • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Involve stakeholders in agricultural mechanization sector to ensure availability and accessibility of machinery, land for trials/demonstrations. • Existence of SACCOs in rice growing areas - liason with ATDC's for operator trainings • Involve IWUA, farmer groups in dissemination • County and Central government support for policy formulation.
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services ATDC's, - sensitization • CaDPERP, KALRO, - Technical advice • Farmers/farmer groups - provide trial sites • Central and County governments, e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination • Kenya School of Agriculture – demonstration sites • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Counties where to be upscaled, _Rice Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• Technology not validated
Suggestions for addressing the challenges	• Comprehensive field trials by Agricultural Engineering Services in collaboration with other stakeholders
Lessons learned in upscaling if any	• Not Applicable
Social, environmental, policy and market conditions necessary for development and upscaling	• Infrastructure challenges may not attract women and youth to venture and operate the tract-tractor. • Some canals are too wide for machinery to cross and may be risky for both experienced and inexperienced gender

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Purchase of i) Chisel plough at approximately KES. 0.5M, ii) Drive Harrow at appx KES.0.65M, iii) Parshall flume (fixed hydraulic structure to be used to measure volumetric flow rate into a paddy field) at appx KES.0.12M.
Estimated returns	Not yet determined
Gender issues and concerns in development dissemination, adoption and scaling up dissemination	• Women and children vulnerable during conflicts related to irrigation water. • Women have limited finances to purchase machinery and equipment for rice production • Machinery service provision controlled by men in male headed households • Youth are mainly sidelined in production aspects of rice value chain • Women and youth have limited access to productive resources such as land and credit. • Women and youth have limited access to education, training and extension services compared to men • Women have less access to agricultural information, technology
Gender related opportunities	• Increasing Youth involvement in novel agricultural mechanization in rice value chain • Credit facilities tailor-made for youth, women and boy child
VMG issues and concerns in development, dissemination, adoption and scaling up	• Access to rice production resources is limited among VMG • Limited access to awareness and training by VMGs • for and available to VMGs
VMG related opportunities	• Potential of increasing employment opportunities, improving productivity and income for VMGs • Formation of groups among VMGs to access services • National government and several organizations have financial packages to support women, youth and vulnerable persons
E: Case studies/profiles of success stories	
Success stories from previous similar projects	RiceMAPP - Mechanization section had initiated field trials in conjuction with JICA but was not concluded
Application guidelines for users	
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	2 - Requires validation
G: Contacts	
Contacts	Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo House, P.O. Box 30028 – 00100, NAIROBI, E-mail: info@kilimo.go.ke. Telephone: +254-20-2718870 Hotline: 0800724891

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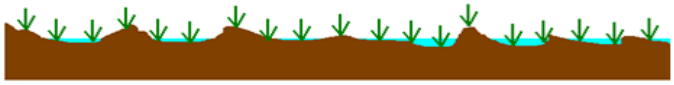
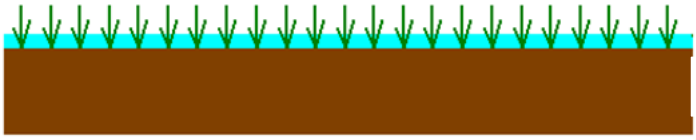
Lead organization and scientists	KALRO; MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP County governments, KiliMOL Ltd

2.13.5 GPS Laser Levelling

2.9.5 TIMP Name	**GPS Laser Levelling**
Category (technology, innovation or management practice)	Innovation  GPS Laser Leveller  Before  After
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Low yields due to uneven crop development arising from non-levelled field causing water to stagnate at the drain canal side i.e. water level is shallow at the inlet side and deeper towards the drain canal. • Uneven flooding is also caused by tyre treads left in the paddy fields after rotavation
What is it? (TIMP description)	• This is a method to achieving level regular and irregular shaped paddy fields, using laser technology and equipment. • The methods involve simple methods for farmers to detect uneven paddy field
Justification	Low rice yields due to non uniform crop establishment and high water requirements for rotavation in pady fields a major challenges in rice production. The deployment of laser technology in detecting and leveling uneven fields enables uniform field establishment of the rice crop and reduces the water requirement for rotavation. This results in reduced costs and improved rice yields.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Rice Growers SACCO's providing machinery hire services, Farmers, Machine Operators, Mechanization service providers, Financial institutions, Researchers, Academia
Approaches used in dissemination	• Shows, Field days and exhibitions • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, posters) • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Involve stakeholders in the agricultural mechanization in sector to ensure availability and accessibility of machinery, land for trials/demonstrations. • Existing SACCO's and farmer groups in rice growing areas. • Involve IWUA, farmer groups in dissemination • County and Central government support for policy formulation.
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services ATDC's, providing technical support in surveying procedures. CaDPERP, KALRO, research organizations provide technical support and backstopping • Existing farmer groups and Cooperative mobilizing farmers. • Central and County governments, e.g. Chiefs, Agricultural Extension (Formal and informal) for mobilizing farmers, sensitization on policy, awareness and dissemination • Kenya School of Agriculture provide venues for training and demonstrations • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot.
Challenges in dissemination	N/A
Suggestions for addressing the challenges	N/A
Lessons learned in upscaling if any	Not yet documented
Social, environmental, policy and market conditions necessary for development and upscaling	• The technology will be socially acceptable (particularly to the women and youth who form the labour force in rice production) in the target communities. • Environmental conditions will be favourable for crop growth during upscaling activities. • Policy environment will be enabling for upscaling of the TIMP

	• The market will be willing and able to absorb the extra produce arising from the increased yields.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Initial cost of the instrument and equipment may be high – Between K.sh. 200,000/- and 1.2million depending on the sophistication.
Estimated returns	Not yet determined
Gender issues and concerns in development dissemination, adoption and scaling up dissemination	• Limited access to information on the technology/innovation by women and youth • Women and youth have limited access to finances to invest in these technologies • Women have less access to agricultural information, technology
Gender related opportunities	• Women and youth are likely to be attracted to invest in the laser leveling equipment including service delivery to farmers hence require to be trained on how to use them • Credit facilities tailor made for youth and women - National government and several organizations have financial packages to support women, youth and vulnerable persons • Formation of groups to access credit and training related to the technology • Youth in agricultural mechanization
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMG may have limited access laser leveling equipment • Limited access to resources by VMG to enable them access and use the technology
VMG related opportunities	• Formation of VMG groups to access the services • National government and several organizations have financial packages to support vulnerable and marginalized groups to access technologies and innovations • Training opportunities targeted at the VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	RiceMAPP - Mechanization section had initiated field trials in Conjuction with JICA but was not concluded
Application guidelines for users	Not yet prepared
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research**)**	Requires validation
G: Contacts	
Contacts	Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo House, P.O. Box 30028 – 00100, NAIROBI, E-mail: info@kilimo.go.ke. Telephone: +254-20-2718870 Hotline: 0800724891 www.kilimo.go.ke

	CaDPERP Mwea Email;- ricemapp@gmail.com
Lead organization and scientists	KALRO; MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP County governments, KiliMOL Ltd

2.13.6 Walk behind multi row mechanical transplanters

2.13.6 TIMP Name	Walk behind 2 & 4 and 4 & 6 row mechanical transplanters
Category (i.e. technology, innovation or management practice)	Technology 2 & 4 row mechanical transplanters  4 & 6 row mechanical transplanters 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity due to non-uniform growth as a result of inadequate labour during transplanting season leading to irregular/improper transplanting depth, uneven spacing and laboriousness of the planting.
What is it? (TIMP description)	This is a self-propelled/motorized transplanter for 4 or 6 rows. The machine can be adjusted to plant 4 or six rows at a time.
Justification	The transplanting machine will reduce drudgery, save time and increase field operations efficiency, thus resulting in reduced operational costs and a uniform crop that realizes high yields.

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Mechanization service providers, Machine operators, Rice SACCOs, Financial institutions, Researchers, Academia
Approaches used in dissemination	• Shows, Field days and exhibitions • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, posters • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Encourage and Promote agricultural mechanization through private sector participation (example JICA has dispatched an advisor to the ministry for an year April 2023 to March 2024) • Involve stakeholders in the agricultural mechanization sector to ensure availability and accessibility of machinery, land for trials and demonstrations. • Collaboration with machinery suppliers (example KiliMOL company that is selling machinery including transplanters) • SACCO's supporting rice growing areas. • Involve farmer groups in dissemination • Financial institutions • County and Central government support
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services ATDC's, providing technical support in surveying procedures. CaDPERP, KALRO, research organizations provide technical support and backstopping • Existing farmer groups and Cooperative mobilizing farmers. • Central and County governments, e.g. Chiefs, Agricultural Extension (Formal and informal) for mobilizing farmers, sensitization on policy, awareness and dissemination • Kenya School of Agriculture provide venues for training and demonstrations • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• The implements may not be readily available • Reluctance in acceptance of new technology • Inadequate extension staff trained in the technology
Suggestions for addressing the challenges	• National and county governments to facilitate staff training

Lessons learned in upscaling if any	• Most machinery service providers and entrepreneurs do not consult relevant technical bodies for machinery specifications, suitability among other technical aspects. • Perceived preference to certain models even before performance validation by relevant bodies.
Social, environmental, policy and market conditions necessary for development and upscaling	• Infrastructure challenges may not attract women and youth to venture and operate the tract-tractor. • Some canals are too wide for machinery to cross and may be risky for both experienced and inexperienced gender • Women and youth will contribute positively in promoting water saving technologies with the changing climatic conditions • Implementation of National Agricultural Mechanization Policy 2021 developed by the ministry of agriculture will enhance uptake of mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The machine costs between K.sh. 300,000 and 1million depending on the model and country of origin
Estimated returns	Not yet computed
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limited access to production resources especially by women and youth • Limited access to land for rice production by youth
Gender related opportunities	• Machine is gender friendly and easy to operate and attracts youth and women in agriculture • Create youth groups to offer service to rice producers • Create job opportunities for youth and women
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to finances to purchase farm machinery. • VMGs may have limited access to land and other production resources • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services related to improved mechanization options • Due to prejudices associated with their social status, VMGs are excluded from access to and benefits from improved technologies.
VMG related opportunities	• Mechanised planting would improve VMGs involvement in rice production • Formation of groups by VMGs to access services and hence be involved in rice production • Access to credit and financing options tailored to VMGs to facilitate access to the technology
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	

F: Status of TIMP readiness (1-ready for upscaling 2-requires validation; 3-requires further research**)**	Ready for upscaling
G: Contacts	
Contacts	Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17 State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo House, P.O. Box 30028 – 00100, NAIROBI, E-mail: info@kilimo.go.ke. Telephone: +254-20-2718870 Hotline: 0800724891 www.kilimo.go.ke
Lead organization and scientists	KALRO; MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP County governments, KiliMOL Ltd

2.13.7 Drum seeder – Direct Seeding rice (4, 6 or 8 row types)

2.13.8 TIMP Name	**Drum seeder – Direct Seeding rice (4, 6 or 8 row types)**
Category (i.e. technology, innovation or management practice)	**Technology** 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity arising from non-uniform growth due to inadequate labour during transplanting season and drudgery of the planting which results in irregular/improper transplanting depth, uneven spacing.
What is it? (TIMP description)	A piece of equipment that delivers pre-germinated rice seed directly onto the field/paddy. It is a hand drawn equipment that can be adjusted to seed 4, 6 or 8 rows at a go making it a low cost precision seeding machine.
Justification	The transplanting machine will reduce drudgery, save time and increase field operations efficiency, thus resulting in reduced operational costs and a uniform crop that realizes high yields
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Rice Farmers, Mechanization service providers, Machine operators, Financial institutions, Researchers, Academia

Approaches used in dissemination	• Shows, Field days and exhibitions • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, posters • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Involve stakeholders in the agricultural mechanization sector to ensure availability and accessibility of machinery, land for trials and demonstrations. • SACCO's supporting rice growing areas. • Involve farmer groups in dissemination • County and Central government support for policy formulation. • Thorough training for seed soaking and other pre seeding requirements will be essential
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services ATDC's, providing technical support in surveying procedures. CaDPERP, KALRO, research organizations to provide technical support and backstopping • Existing farmer groups and Cooperative mobilizing farmers. • Central and County governments, e.g. Chiefs, Agricultural Extension (Formal and informal) for mobilizing farmers, sensitization on policy, awareness and dissemination • Kenya School of Agriculture to provide venues for training and demonstrations • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• The implements may not be readily available • Reluctance in acceptance of new technology • Inadequate extension staff trained in the technology
Suggestions for addressing the challenges	• Collaborate with agro-equipment dealers • Ensure extension staff are well trained before disseminating the technology • National and county governments to facilitate extension staff training
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions	• The technology will be acceptable as it poses a threat to employable labour

necessary for development and upscaling	• The environmental conditions will be suitable for demonstration of the machine during upscaling • Policy environment will be friendly • Market will be able to absorb the extra produce arising from the use of the machine
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES.3,000/- per unit
Estimated returns	Value of rice produced per acre using GAPs
Gender issues and concerns in development, dissemination, adoption and scaling up dissemination	- This is a manually operated implements that may not favour women - Limited access to finances to purchase machinery - Limited access to production resources in rice to enable use/purchase of the technology
Gender related opportunities	• Compliant to issues that would be considered unfavourable and of concern to either gender.. • No known incidents of injury during its use hence gender friendly • Formation of groups (youth) to provide the service • Access to financing options to enable youth provide the service
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to finances to purchase farm machinery. • Some VMGs may not be able to use the technology as it is manually operated • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services. • Due to prejudices associated with their social status, VMGs are excluded from access to and benefits from improved technologies.
VMG related opportunities	• The implement could provide entrepreneurial opportunities for VMGs by providing the seeding services • No known incidents of injury during its use hence gender friendly • Formation of groups (VMGs) to access the service • Access to financing options to enable VMGs provide the service
E: Case studies/profiles of success stories	
Success stories	Tested in most rice irrigation schemes
Application guidelines for users	Available from KALRO, NIA and ATDC's
F: Status of TIMP readiness (1-ready for upscaling 2-requires validation; 3-requires further research**)**	Ready for upscaling
G: Contacts	
Contacts	Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/1

	National Irrigation Authority
Lead organization and scientists	KALRO; MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP County governments, KiliMOL Ltd

2.13.8 Motorised (2-row) paddy field weeder

2.13.8 TIMP Name	**Motorised (2-row) paddy field weeder**
Category (i.e. technology, innovation or management practice)	Technology   
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields and productivity due to inadequate or improper weeding because of shortage of labour and drudgery of weeding
What is it? (TIMP description)	This is a motorized walk behind mechanical weeder. It is relatively light, weighing only about 10 kg.
Justification	The mechanical weeder reduces weeding drudgery, saves time and improves the efficiency of weeding. This leads to realization of higher yields due to better soil aeration and water intake by the crop.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Mechanization service providers, Machine operators, Rice SACCO's, Financial institutions, Researchers, Academia
Approaches used in dissemination	• Shows, Field days and exhibitions • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings

	• Publications (Brochures, factsheets, pamphlets, manuals, poste • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Involve stakeholders in the agricultural mechanization sector to ensure availability and accessibility of machinery, land for trials and demonstrations. • Existing SACCO's and farmer groups supporting rice growing areas. • Involve farmer groups in dissemination • County and Central government support for policy formulation.
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services ATDC's, providing technical support in surveying procedures. CaDPERP, KALRO, research organizations provide technical support and backstopping • Existing farmer groups and Cooperative mobilizing farmers. • Central and County governments, e.g. Chiefs, Agricultural Extension (Formal and informal) for mobilizing farmers, sensitization on policy, awareness and dissemination • Kenya School of Agriculture provide venues for training and demonstrations • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Tested in Kirinyaga by RiceMAPP
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• The implements may not be readily available • Reluctance in acceptance of new technology • Inadequate extension staff trained in the technology
Suggestions for addressing the challenges	• Conduct sensitization similar to that used by RiceMAPP during introduction of rice combine harvesters • Involvement of youth and all stakeholders in the areas its being promoted
Lessons learned in upscaling if any	• Preference to chemical weed control compared to mechanical weeder.
Social, environmental, policy and market conditions necessary for development and upscaling	• The technology will be acceptable as it poses a threat to employable labour • The environmental conditions will be suitable for demonstration of the machine during upscaling. • Policy environment will be friendly for upscaling of the technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	

Estimated cost	K.SH. 100,000/- for the motorized weeder
Estimated returns	Not yet determined
Gender issues and concerns in development, dissemination, adoption and scaling up dissemination	• Implement may be too heavy for women to operate • Limited access to finances to purchase machinery • Limited access to production resources in rice to enable use/purchase of the technology
Gender related opportunities	• No known incidents of injury during its use hence gender friendly • Formation of groups (youth) to provide the service • Access to financing options to enable youth provide the service
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to finances to purchase farm machinery. • Some VMGs may not be able to use the technology due to manual nature • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services. • Due to prejudices associated with their social status, VMGs are excluded from access to and benefits from improved technologies.
VMG related opportunities	• Formation of groups (VMGs) to offer the services for a fee • No known incidents of injury during its use hence gender friendly • Formation of groups (VMGs) to access the service • Access to financing options to enable VMGs provide the service
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	
F: Status of TIMP readiness (1-ready for upscaling 2-requires validation; 3-requires further research**)**	Ready for upscaling
G: Contacts	
Contacts	Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/1 State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo hq's P.o. Box 30028 – 00100 NAIROBI E-mail: info@kilimo.go.ke Telephone: +254-20-2718870 Hotline: 0800724891 www.kilimo.go.ke

	ATDC Siakago (atdcsiakago1@gmail.com) ATDC's
Lead organization and Scientists	KALRO; MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP, County governments, KiliMOL Ltd

2.13.9 Motorized Backpack fertilizer Spreader

2.12.9 TIMP Name	**Motorized Backpack fertilizer Spreader**
	
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Low yields due to uneven crop as a result of uneven spread of fertilizer. • Drudgery associated with manual application of fertilizer.
What is it? (TIMP description)	A motorized equipment for the spreading of fertilizer in the field. The machine Minimizes long period of fertilizer contact with the hands and reduces the chances of fertilizer spillage. It can be calibrated to suit various fertilizer types.
Justification	One cause of uneven crop stand is uneven fertilizer spread in the field. The mechanical fertilizer spreader when properly used, achieves an even spread of fertilizer and thereby enabling a crop to realize its optimum yields whil also reducing drudgery and saving on time.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Mechanization service providers, Machine operators, Rice SACCO's, Financial institutions, Researchers, Academia
Approaches used in dissemination	• Shows, Field days and exhibitions • On-farm visits • Digital platforms (Apps websites social media)

	• Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, poster • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Involve farmer groups in dissemination • Involve stakeholders in the agricultural mechanization sector to ensure availability and accessibility of machinery • Tax exemption for motorized spreaders • Existng SACCO's and farmer groups supporting rice growing areas. • County and Central government support for policy formulation.
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services ATDC's, • CaDPERP, KALRO, research organizations offer technical support and backstopping • Existing farmer groups and cooperatives – to mobilise farmers for upscaling activities • Central and County governments, e.g. Agricultural Extension (Formal and informal) for mobilization of farmers, policy, awareness and dissemination • Kenya School of Agriculture, provide training and demonstration venues • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga county by CaDPERP
Counties where TIMP will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• Initial resistance by workers normally hired for manual spreading by hand. • Inadequate funding for promotion activities • Inadequate trained extension staff
Suggestions for addressing the challenges	• Employ private public partnerships in dissemination activities • Engage national and county governments for funding and capacity building of extension staff
Lessons learned in upscaling if any	• None yet but some individual farmers own similar equipment
Social, environmental, policy and market conditions necessary for development and upscaling	• Technology acceptability as it poses a threat to employable labour • The environmental conditions will be suitable for demonstration of the machine during upscaling. • Policy environment will be friendly • Market will be able to absorb the extra produce arising from the use of the machine

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	
Estimated returns	Approximately cost of Spreader is KES.50,000/-
Gender issues and concerns in development, dissemination, adoption and scaling up Dissemination	• The equipment may require specialized training to use and may hence be unavailable for women and youth not directly involved in rice production • Limited access to credit facilities by women and youth to purchase the implement • Limited access by women and youth to rice production resources where the technology would be applied
Gender related opportunities	• Encourages involvement of youth and men in agricultural mechanization of rice production • Credit facilities tailor-made for youth and women
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited access to rice production resources by VMGs • Limited access to finance by VMGs to access the service
VMG related opportunities	• Group formation by VMGs to access services • Potential of increasing employment opportunities, improving productivity and income for women and youth • Has potential to improve food security and nutrition for women and youth
E: Case studies/profiles of success stories	
Success stories	Yet to be documented by CaDPERP
Application guidelines for users	To be developed by CaDPERP
F: Status of TIMP readiness (1-ready for upscaling 2-requires validation; 3-requires further research**)**	2- requires validation
G: Contacts	
Contacts	CaDPERP Mwea Email;- ricemapp@gmail.com State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo hq's P.o. Box 30028 – 00100 NAIROBI E-mail: info@kilimo.go.ke Telephone: +254-20-2718870 Hotline: 0800724891 www.kilimo.go.ke ATDC Siakago Email;- atdcsiakago1@gmail.com Center Director, KALRO – Mwea PO Box 298-10300, Kerugoya Phone; 02028216/17

Lead organization and Scientists	KALRO; MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP, County governments, KiliMOL Ltd

2.13.10 Mini Rice Mills

2.12.9 TIMP Name	**Mini Rice Mills**
	 Mini Rice mill, up to 250kg white rice per hour
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss due to post harvest losses of un-milled rice, arising from lack of rice milling services for small scale farmers in upland ecology
What is it? (TIMP description)	This is a low volume rice mill that can mill smaller quantities of rice.
Justification	Rice farming in the upland ecologies is not yet fully developed. There is thus an inadequacy of rice mills in these regions as the established rice mills are located at far off distances as to be uneconomical to transport the small quantities of rice produced. The small rice mills can easily be installed in the upland areas within the vicinity of production. This will prevent the yield losses arising from the un-milled rice, which is less marketable and utilizable.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Government, Mechanization service providers, Machine operators, Rice SACCO's, Financial institutions, Researchers including the Academia
Approaches to be used in dissemination	• Shows, Field days and exhibitions • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, posters) • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Involve farmer groups in dissemination • Involve stakeholders in the agricultural mechanization sector to ensure availability and accessibility of machinery

	• Tax exemption for motorized spreaders for affordability and availability of the machines • Existing SACCO's and farmer groups. • County and Central government support for policy formulation.
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services. Regional • ATDC's, CaDPERP, KALRO, research organizations Farmers/farmer groups for technical support and backstopping • Central and County governments, e.g. Agricultural Extension (Formal and informal) for policy, awareness and dissemination • Kenya School of Agriculture for venue of trainings and demonstrations • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Kisumu, Busia among other counties
Counties where TIMPs will be up scaled	Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in development and dissemination	• Unaffordability of the equipment • Inappropriate infrastructure in some rural areas • Inadequate rice quantities to sustain the available mills • Inadequate funding for dissemination activities
Suggestions for addressing the challenges	• Mobilization of farmers into farmer groups and cooperatives • Mobilization of funds for dissemination, through county and national governments
Lessons learned in upscaling if any	Technology has been adopted very fast in some areas where upland rice ecology has been adopted Supply and demand of rice has influenced selling prices including investment in the rice value chain
Social, environmental, policy and market conditions necessary for development and up-scaling	• The communities will accommodate establishment of the mini rice mills • The environmental conditions will be conducive for the production of rice to ensure adequate supply of rice to run the mills • The policy environment will be friendly to the establishment of the mini rice mills
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	A small rice mill with a capacity to mill upto 500kg per hour would cost about K.sh. 450,000 to 650,00/-
Estimated returns	Yet to be computed
Gender issues and concerns in development and dissemination, adoption and scaling	• Limited access to finances to purchase machinery • Limited access to production resources in rice to enable use/purchase of the technology
Gender related opportunities	• Compliant to issues that would be considered unfavourable and of concern to either gender.

	• No known incidents of injury during its use hence gender friendly • Formation of groups (youth) to provide the service • Access to financing options to enable youth provide the service
VMG issues and concerns in development and dissemination, adoption and scaling up	• VMGs may have limited access to finances to purchase farm machinery. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services.
VMG related opportunities	• Formation of groups (VMGs) to offer the services for a fee • No known incidents of injury during its use hence gender friendly • Formation of groups (VMGs) to access the service • Access to financing options to enable VMGs provide the service
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Not yet recorded
Application guidelines for users	Yet to be developed
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Rice Promotion Programme – RIPP State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo hq's P.o. Box 30028 – 00100 NAIROBI E-mail: info@kilimo.go.ke Telephone: +254-20-2718870 Hotline: 0800724891 www.kilimo.go.ke CaDPERP Mwea Email;- ricemapp@gmail.com
Lead organization and Scientists	KALRO; MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP, County governments, KiliMOL Ltd

2.13.11Rice Combine Harvester

2.13.11 TIMP Name	Rice Combine Harvester
	 
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Harvest and post-harvest losses arising from inefficient harvest and post handling operations. • Loss in quality due to inappropriate and inefficient post handling activities
What is it? (TIMP description)	A machine that harvests, threshes and winnows rice in one operation.
Justification	Separate harvest, threshing and winnowing operations contribute to post harvest and loses of rice. Drudgery of the three operations when performed manually also leads to loss of yields and quality. The combine harvester improves efficiency of the harvest and post-harvest handling of rice, while significantly reducing losses.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Mechanization service providers, Machine operators, Agripreneurs, Rice SACCO's, Financial institutions, Researchers, Academia
Approaches used in dissemination	• Shows, Field days and exhibitions • On-farm visits • Digital platforms (Apps websites social media) • Mass media (electronic and print) • Farmer Trainings • Farmer to farmer trainings • Publications (Brochures, factsheets, pamphlets, manuals, poste • On-farm demonstrations • AIPs
Critical/essential factors for successful promotion	• Involve farmer groups in dissemination • Involve stakeholders in the agricultural mechanization sector to ensure availability and accessibility of machinery • Tax exemption for motorized spreaders • Existing SACCO's and farmer groups supporting rice growing areas. • County and Central government support for policy formulation.
Partners/stakeholders for scaling up and their roles	• MOALD - Agricultural Engineering Services ATDC's, • CaDPERP, KALRO, research organizations for technical support, and backstopping

	• Central and County governments, e.g. Agricultural Extension (Formal and informal) for farmer mobilization, policy, awareness and dissemination • Kenya School of Agriculture to provide venue for training and demonstrations. • Financial institutions e.g. Banks and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga county by RiceMAPP, CaDPERP
Counties where TIMP will be up scaled	All rice growing counties where rice is grown in well irrigated regular shaped paddy and upland rice fields. Busia, Kisumu, Homa Bay, Baringo, Kirinyaga, Tana River, Taita Taveta, Meru, Embu, Nyeri, Muranga, Narok, Kwale Kilifi, Lamu, Tharaka Nithi, Siaya, Kakamega, Vihiga, Bungoma, Trans Nzoia, West Pokot
Challenges in dissemination	• Possibilities of initial resistance by workers normally hired for manual harvesting. • Inadequate funding for dissemination activities and materials • Inadequate trained extension staff for dissemination activities
Suggestions for addressing the challenges	• Identify and use well trained technical staff to sensitize and train farmers, interested entrepreneurs and machine operators • Employ private public partnerships in dissemination activities
Lessons learned in upscaling if any	None yet but some individual farmers own similar equipment
Social, environmental, policy and market conditions necessary for development and upscaling	• The technology will be acceptable as it poses a threat to employable labour • The environmental conditions will be suitable for demonstration of the machine during upscaling. • Policy environment will be friendly for upscaling of the technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Not yet determined
Gender issues and concerns in development, dissemination, adoption and scaling up Dissemination	• Limited access to finances to purchase machinery • Limited access to production resources in rice to enable use/purchase of the technology
Gender related opportunities	• Compliant to issues that would be considered unfavourable and of concern to either gender. • No known incidents of injury during its use hence gender friendly • Formation of groups (youth) to provide the service • Access to financing options to enable youth provide the service
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to finances to purchase farm machinery.

	• Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to education, training and extension services.
VMG related opportunities	
E: Case studies/profiles of success stories	
Success stories	Yet to be documented
Application guidelines for users	To be prepared by CaDPERP
F: Status of TIMP readiness (1-ready for upscaling 2-requires validation; 3-requires further research**)**	1-ready for upscaling
G: Contacts	
Contacts	Rice Promotion Programme – RIPP State Department for Crop Development Directorate of Agricultural Engineering Services – Kilimo hq's P.o. Box 30028 – 00100 NAIROBI E-mail: info@kilimo.go.ke Telephone: +254-20-2718870 Hotline: 0800724891 www.kilimo.go.ke CaDPERP Mwea Email;- ricemapp@gmail.com ATDC Siakago Email;- atdcsiakago1@gmail.com
Lead organization and Scientists	KALRO; MOALD - Agricultural Engineering Services Department
Partner organizations	MOALD - Agricultural Engineering Services Department and Rice Promotion Programme – RIPP, County governments, KiliMOL Ltd

2.14 RICE FARMING BUSINESS AND MARKETING

2.14.1 Transformative production model

2.13.1 TIMPs NAME	**Transformative production model**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Market inefficiencies in rice production due to lack of producer and marketers organization
What is it? (TIMP description)	An approach to organize rice production based on market orientation. Transition from subsistence to commercial production

	through producer-organized, buyer led or intermediary-driven market model
Justification	Lack of organized production and marketing of rice caused by liberalization leads to low prices, market malpractices and high competition from imports. Thus low production and incomes.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension personnel, policy makers, researchers
Approaches to be used in dissemination	Digital apps, mass media, stakeholder meetings, exhibitions, field days
Critical/essential factors for successful promotion	• A platform for interaction of rice value chain stakeholders, • Producers acceptance of improved technologies and collective action in rice production • Availability of rice enterprise investors, buyers, • Competitive prices for rice
Partners/stakeholders for scaling up and their roles	• Millers, traders, agripreneurs,, cooperatives, NGOs, Research Organizations, CARDPERP, Agrochemical companies, NIA
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Busia
Counties where TIMPs will be up scaled	Kirinyaga, Busia, Migori, Homa Bay, Kisumu, Elgeyo Marakwet, Baringo, Uasin Gishu, Garissa, Tana River, Taita Taveta, Siaya, Tharaka Nithi, Lamu, Kilifi, Kwale, West Pokot, Trans Nzoia, Bungoma, Kakamega, Vihiga, Narok, Nyeri, Muranga, Meru, Embu
Challenges in development and dissemination -	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Minimal collective action among rice farmers • Lack of cohesiveness, • The enterprise is new in some regions • Small-scale farming with low economies of scale, • Lack of training in group dynamics • Prices of rice and level of policy support
Suggestions for addressing the challenges	• Establish rice innovation platforms, • Disorganization among farmers – Formation of marketing groups, • Small-scale farming – Aggregation of produce, • Group dynamics – Capacity building, • Regulate prices and enhance policy support
Lessons learned in upscaling if any	• Farmer organizations not very effective because of history of mistrust and management issues • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Need to have a partner who brings together the farmers, to enhance cohesion
Social, environmental, policy and market conditions necessary for development and up-scaling	• Social: Adoption of rice production and marketing technologies including collective action by all gender, • Environmental: Ecologies/zones more adapted to rice production

	• Market: Working markets with favourable prices and ways of reducing malpractice • Policy: Policy supporting transformative markets in rice production
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES.80,595 per acre (without subsidy) – investing in rice production as recommended
Estimated returns	KES.106,905 per acre (without subsidy)
Gender issues and concerns in development and dissemination, adoption and scaling	• Women are widely discriminated in rural producer organizations that are linked to markets. • Women have limited access to markets.
Gender related opportunities	• Men and youth stand to benefit with higher profit margins through collective bargaining during marketing • Women through women groups also stand to benefit from higher profit margins
VMG issues and concerns in development and dissemination, adoption and scaling up	• VMGs are widely discriminated in rural producer organizations that are linked to markets.
VMG related opportunities	• VMGs stand to benefit with higher profit margins through collective bargaining and marketing • Opportunities exist for unemployed youth in production and marketing through ICT
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mwea Rice growers' Cooperative society is a success story. It's the major rice producer and marketing organization operating fairly.
Application guidelines for users	Fact sheets and manuals are available at Kalro Mwea
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	1 - Ready for upscaling
G: Contacts	
Contacts	The Centre Director, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO, NIA,
Partner organizations	MRGM, CGIAR, NGOs

2.14.2 Building a business plan

2.13.2. TIMP Name	Building a business plan
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low/poor farm management and lack of sustainability and success in rice farming business due to lack of business plans.
What is it? (TIMP description)	A rice business plan is an internal management and organizing tool, that helps farmers plan, monitor operations and expenses as well as yield and returns.
Justification	With a business plan in hand, rice farmers and rural entrepreneurs will be able to take that first step toward the creation of a successful and sustainable business. Business plan provides a visual of identifying where costs may be too high or returns are being lost
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, agripreneurs,, processors, extension personnel
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), Trainings, factsheets, manuals
Critical/essential factors for successful promotion	• A platform for interaction of rice value chain stakeholders, • Education levels of the farmers and investors in rice production, • Availability of accurate information on rice production and marketing, • Availability of seed and other inputs in good quality, at the right time and price • Producers adopting improved rice production technologies, innovations and management practices • Opportunities for diversification of enterprises and by-products through value addition, • Well organized farmer groups and networks, • Good Marketing Models and path ways, • County and central government support, • Funding to research to validate and promote new improved rice varieties and other innovations and technologies
Partners/stakeholders for scaling up and their roles	• Farmers – Users of business plans, • County extension staff - capacity building, • NGOs – Capacity building, • Private sector (local traders, agripreneurs,, exporters)-buyers of rice, • Research institutions – Capacity building, • Financial Institutions-financial support
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga
Counties where TIMPs will be up scaled	Kirinyaga, Busia, Migori, Homa Bay, Kisumu, Elgeyo Marakwet, Baringo, Uasin Gishu, Garissa, Tana River, Taita Taveta, Siaya,

	Tharaka Nithi, Lamu, Kilifi, Kwale, West Pokot, Trans Nzoia, Bungoma, Kakamega, Vihiga, Narok, Nyeri, Muranga, Meru, Embu
Challenges in development and dissemination -	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Low level of education among target farmers • Small-scale farming, • Inadequate information to stakeholders on rice production and marketing, • Levels of policy support
Suggestions for addressing the challenges	• Establish rice innovation platforms • Education – Develop simple to understand tools and build capacity on the same • Small-scale farming – aggregation of production to assume large scale-farming • Inadequate information to stakeholders on the rice production – Developing information hub • Level of policy support – support in extension services
Lessons learned in upscaling if any	Chances of successful scaling are higher when simple tools are used
Social, environmental, policy and market conditions necessary for development and up-scaling	Social conditions – Ability to develop simple business planning tools that can be accessed/used by all farmers regardless of eduction levels; Groups to assist in decision making Environmental conditions – Availability of water resources and good irrigation infrastructure Market conditions – Availability of reliable market information Policy conditions – Policy support in opportunities selected
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Investing in business planning has limited cost
Estimated returns	With efficient planning and management, farmers able to attract KES.60 per kg
Gender issues and concerns in development and dissemination, adoption and scaling	• High illiteracy levels of women leading to lack of record keeping and poor records • Limited access to effective business planning information and tools by women
Gender related opportunities	• Being a cash crop, opportunities exist for youth since they are highly literate and can be able to come up with good business plans • Women groups can be a source of training and capacity building on business planning
VMG issues and concerns in development and dissemination, adoption and scaling up	• Where there is high illiteracy levels among VMGs coupled with lack of record keeping and poor records, adoption of business planning is hampered • Limited access to effective business planning information and tools by VMGs
VMG related opportunities	• Being a cash crop, opportunities exist for VMGs for capacity building towards good business planning • VMG groups can be a source of training and capacity building on business planning
E: Case studies/profiles of success stories	

Success stories from previous similar projects	
Application guidelines for users	Manuals, and Fact sheets at Kalro Mwea
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO, CARDPERP,
Partner organizations	NIA, CGIAR, NGOs, Millers

2.14.3 Marketing as a group – collective marketing

2.13.3. TIMP Name	**Marketing as a group – collective marketing**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low income from rice production due to lack of collective action among farmers. Marketing rice as an individual farmer increases inaccessibility to markets due to low volumes, limited bargaining power, low prices due to exploitation by middlemen and high transaction costs
What is it? (TIMP description)	Collective marketing is where a number of growers pool together their farm produce so as to enhance their access to markets, bargaining power and get better price. Collective marketing approach which involves formation of a group of farmers with an objective of reducing market inaccessibility and costs
Justification	Due to small-scale farming of rice, marketing as a group would enable farmers to gain from economies of scale. The advantages of collective marketing are bigger volumes, uniform quality, reliable sellers, reliable buyers, higher bargaining power, access to more organized markets, higher prices and organization
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, farmer cooperatives, rice buyers, extension staff, researchers
Approaches to be used in dissemination	• Farmer field and business Schools(FFBS), • Agricultural Innovation Platforms (AIP), • Trainings, • Print media including factsheets, manuals

Critical/essential factors for successful promotion	• A platform for interaction of rice value chain stakeholders, • Commitment to the collective marketing agreement by farmers including adherence to the production cycle outlined • Producers adopt improved rice technologies, innovations and management practices • Favourable weather • Reliable and secure aggregation points and record keeping
Partners/stakeholders for scaling up and their roles	• Farmers – Defining production programme, • county extension staff - capacity building, • NGOs – Capacity building • Processors,traders, agripreneurs,-off-take of the produce • Farmer cooperatives-mobilization of farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Busia
Counties where TIMPs will be up scaled	Kirinyaga, Busia, Migori, Homa Bay, Kisumu, Elgeyo Marakwet, Baringo, Uasin Gishu, Garissa, Tana River, Taita Taveta, Siaya, Tharaka Nithi, Lamu, Kilifi, Kwale, West Pokot, Trans Nzoia, Bungoma, Kakamega, Vihiga, Narok, Nyeri, Muranga, Meru, Embu
Challenges in development and dissemination -	• The market is liberal leading to disorganization and scattered farmers, • Farmers not honoring the collective marketing agreement arrangement – side selling • Inadequate information to stakeholders on rice production and marketing, • Mismanagement of collective marketing groups leading to lack of trust, • Low levels of policy support
Suggestions for addressing the challenges	• Establish rice innovation platforms, • Disorganization and scattered farmers – Formation of production clusters, • Inadequate information – Establish market information systems • Level of policy support – support in extension services
Lessons learned in upscaling if any	• Lack of trust, mismanagement issues affects collective marketing
Social, environmental, policy and market conditions necessary for development and up-scaling	• Social conditions – trust among members is of essence. Have an oversight organization with no vested interests • Environmental conditions – favorable weather to facilitate aggregation of produce • policy conditions – Infrastructural and price support • Market conditions- competitive prices and market informaiton
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost includes group membership costs
Estimated returns	KSH. 106,905 per acre (without subsidy)
Gender issues and concerns in development and dissemination, adoption and scaling	• Men groups are not common and shrouded with mistrust and leadership issues • Women are often widely discriminated in rural producer organizations including leadership

	• Women also have limited active participation and influence in rural producer organizations • Socio-cultural norms may limit women's participation and leadership in rice collective marketing groups • Women's double and triple roles means they may not have time to participate • Women are often not involved in household decision making of rice marketing • Strict rules of entry and requirements of producers' organizations may limit women participation
Gender related opportunities	• Men and youth stand to benefit with higher profit margins through collective bargaining during marketing • Women groups are more active and can hence benefit from collective marketing
VMG issues and concerns in development and dissemination, adoption and scaling up	• VMGs are widely discriminated in rural producer organizations • VMGs also have limited participation and influence in rural producer organizations • VMGs may not be very involved in rice production
VMG related opportunities	• VMGs stand to benefit with higher profit margins through collective bargaining and marketing
E: Case studies/profiles of success stories	
Success stories from previous similar projects	The Mwea Rice Growers Multipurpose Society (MRGM) is a success story.
Application guidelines for users	Manuals and fact sheets at Kalro Mwea
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	1 – Ready for upscaling
G: Contacts	
Contacts	The Centre Director, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO Mwea
Partner organizations	MRGM, NIA, NGOs, Private traders, agripreneurs,

2.14.4 Profitability analysis – performance of Rice agro-enterprise

2.13.4. TIMP Name	**Profitability analysis – performance of Rice agro-enterprise**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of profitability analysis by farmers, leading to lack of comparison of costs and returns and therefore poor performance or exploitation by traders, agripreneurs,

What is it? (TIMP description)	Profitability analysis is the process of calculating and analyzing profits from an enterprise. It involves recording of costs and returns and therefore determination of price and profit which indicates the performance of the rice enterprise
Justification	Profitability analysis reviews the management success and sustainability of the rice business. It helps identify the revenue as well as areas of adjustment to maximize benefits
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Financial Institutions (credit and insurance), Extension staff, Agripreneurs, NGOs, researchers
Approaches to be used in dissemination	• Farmer field and business Schools (FFBS), • Agricultural Innovation Platforms (AIP), • Trainings, factsheets, manuals
Critical/essential factors for successful promotion	• A platform for interaction of rice value chain stakeholders, • Producers adopt improved rice technologies, innovations and management practices • Expertise in record keeping of costs and returns • Ability of farmers to keep records and to interpret the analysis
Partners/stakeholders for scaling up and their roles	• Farmers – record keeping, • County extension staff – Facilitators and capacity building, • NGOs – Facilitators, • Private sector (local traders, and exporters) – Buyers, • Research institutions – Facilitators • CGIAR-facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga, Embu
Counties where TIMPs will be up scaled	Kirinyaga, Busia, Migori, Homa Bay, Kisumu, Elgeyo Marakwet, Baringo, Uasin Gishu, Garissa, Tana River, Taita Taveta, Siaya, Tharaka Nithi, Lamu, Kilifi, Kwale, West Pokot, Trans Nzoia, Bungoma, Kakamega, Vihiga, Narok, Nyeri, Muranga, Meru, Embu
Challenges in development and dissemination -	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Limited knowledge on record keeping and profit analysis • Use of non-costed family labour in rice production
Suggestions for addressing the challenges	• Establish rice innovation platforms, • Inability of farmers to keep records – capacity building, • use of non-costed family labour in rice production – capacity building on how to utilize and cost family labour
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions	• Social conditions – Awareness on record keeping for all gender; collective capacity building in profit analysis

necessary for development and up-scaling	• Environmental conditions – suitable for the increased production of irrigated and upland rice. • Policy conditions – Policy support in costs of inputs and prices of outputs, • market conditions – Competitive prices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Profit analysis costs are minimal and may entail group membership
Estimated returns	KSH. 106,905 per acre (without subsidy)
Gender issues and concerns in development and dissemination, adoption and scaling	• High illiteracy levels of women leading to lack of record keeping and poor record keeping. • Limited interpretation capacity of the analysis • Women family labour is often not costed
Gender related opportunities	• Opportunities exist for youths to venture in this management practice since majority are literate and can be able to keep good farm record
VMG issues and concerns in development and dissemination, adoption and scaling up	• Some of the VMGs are illiterate hence cannot keep good records. • Limited interpretation capacity of the analysis
VMG related opportunities	• Opportunities exist for youths to venture in this management practice since majority are literate and can be able to keep good farm record. • Opportunities for VMGs to provide profitability analysis services
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Rice production is profitable (especially in the Mwea Irrigation Scheme)
Application guidelines for users	Training factsheets, manuals
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	1 – Ready for upscaling
G: Contacts	
Contacts	The Centre Director, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO Mwea, CARDPERP
Partner organizations	MRGM, NIA, CGIAR

2.14.5 Contracted production model

2.13.5. TIMP Name	Contracted production model
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low revenue from rice production due to market failure in rice production which has led to low prices, low production and poor quality
What is it? (TIMP description)	Contract farming is an agreement between farmers and marketing and/or processing companies for the production and supply of rice. It involves private companies extending lines of credit to producers in the form of farming inputs and technical assistance in exchange of assured supply and producer prices. Under contract farming terms, contractors commit themselves to buy the entire product at an agreed price while producers commit to avail produce at agreed-upon quality and quantity
Justification	Without contract farming smallholder farmers realize low prices for their produce. Contract farming is a contractual arrangement between producers and buyers of a farm product. The contract can either be oral or written, and will specify one or more conditions of production and marketing of an agricultural product. In essence, contract farming commits the farmer to produce a certain commodity at a certain time for an agreed price and, in return, the contractor undertakes to buy the commodity, and may provide agricultural extension and other services to producers in order to satisfy production requirements in terms of quality and quantity. The benefits of contract farming to farmers are market access, increased incomes, reduction in the risk of price fluctuations, credit and financial inter-mediation, timely provision of inputs, monitoring and labour incentives, reduction of production risk, introduction of higher-value crops, improved collective bargaining, household spill-over benefits and improved access to extension. A written contract farming is recommended.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, private or public traders, millers, extension agents, agripreneurs,, Researchers, farmer cooperative societies
Approaches to be used in dissemination	• Farmer field and business Schools (FFBS), • Agricultural Innovation Platforms (AIP), • Barazas, • Trainings, • Print media including factsheets, manuals, media
Critical/essential factors for successful promotion	• A platform for interaction of rice value chain stakeholders, • Willing farmers and willing buyers/processors • Competitiveness of rice, • Favourable weather to ensure production volumes • Adoption of recommended management practices to ensure quality and quantity of produce

	• Enforcement party to ensure binding contract farming
Partners/stakeholders for scaling up and their roles	• Farmers – Contract party and beneficiaries, • County extension staff - Capacity building, signing contract • NGOs – Capacity building, • Private sector (local traders, agripreneurs, and exporters) – Contract party and beneficiaries • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	Kisumu, Busia, Migori
Counties where TIMPs will be up scaled	Kirinyaga, Busia, Migori, Homa Bay, Kisumu, Elgeyo Marakwet, Baringo, Uasin Gishu, Garissa, Tana River, Taita Taveta, Siaya, Tharaka Nithi, Lamu, Kilifi, Kwale, West Pokot, Trans Nzoia, Bungoma, Kakamega, Vihiga, Narok, Nyeri, Muranga, Meru, Embu
Challenges in development and dissemination -	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders, • History of dishonored contracts creating mistrust among farmers • disorganization and scattered farmers leading to low volumes and hence high cost of aggregation by contractor • Small-scale farming, • Lack of sufficient information by part of the producers to enhance their bargaining power, • Low level of policy support, • Price competition from imports.
Suggestions for addressing the challenges	• Establish rice innovation platforms, • Dishonored contracts – Extension staff and administrative office to oversee contract signing • Disorganization – formation of production clusters, • Small-scale farming – Increase volume through increase in productivity and number of farmers in a region, • County policy formulation and enforcement • Enforcement of contract farming
Lessons learned in upscaling if any	• Stakeholder platforms and partnerships are important in technology adoption and dissemination, • Availability of guaranteed market • Increased benefits
Social, environmental, policy and market conditions necessary for development and up-scaling	• Social conditions – Contract farming requires trust and commitment by all players and enforcement of rules for it to succeed. • Environmental conditions – suitable land, agricultural practices that ensure environmental sustainability. • Policy conditions – Policy support in formulation of contracts and enforcement • Market conditions – volume, place, price, promotion, traders, agripreneurs,
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The cost of entering into contracts

Estimated returns	KES.106,905 per acre (without subsidy)
Gender issues and concerns in development and dissemination, adoption and scaling	• Women have less access to knowledge and information on contract farming. • Women and youth have less access to land for farming hence its men who enter into contracts. • Women have less access to credit required to purchase the required inputs for contract farming
Gender related opportunities	• Opportunities exist for women to access the required credit through the women enterprise funds and other opportunities • Opportunities exist for youths to enter into contract farming through renting of land for farming for increased profit margins.
VMG issues and concerns in development and dissemination, adoption and scaling up	• VMGs have less access to knowledge and information on contract farming. • VMGs have less access to credit required to purchase the required inputs for contract farming • VMGs have less access to land for rice farming • Limited clustering of VMG rice farmers makes contract farming very costly
VMG related opportunities	• Opportunities exist for VMGs to access the required credit through the Uwezo funds • Opportunities exist for VMGs to enter into contract farming through renting of land for farming for increased profit margins.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	First project in the initial stages
Application guidelines for users	Contract rice farming module, Kalro Mwea
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	2 – Requires validation
G: Contacts	
Contacts	The Centre Director, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO: Lucy Muthoni John Kimani Ruth Musila
Partner organizations	Green Tec Hub, CARDPERP, NIA, Farmer Cooperatives, Millers and other private companies.

2.14.6 Digital Marketing

2.13.6. TIMP Name	Digital Marketing
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Low revenue from rice production due to poor market access occasioned by constraints in marketing channels, competition, skills and market information
What is it? (TIMP description)	Digital or online marketing is the promotion of brands to connect with potential customers using electronic media as a marketing channel. This could be the internet and other forms of digital communication like email, social media, web-based advertising, text and multimedia messages
Justification	Due to change in technology digital marketing is increasingly becoming a requisite for businesses of all types. It is an important tool that farmers engaging in farm business can take advantage of to promote their rice products and/or supporting services to a wider network of clients/customers. Consumers use a variety of online methods for finding, researching, and eventually making purchasing decisions. Digital marketing enables global customer reach and reduces costs.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Traders, agripreneurs,, rice farmers, processors, rice production service providers
Approaches to be used in dissemination	Agricultural innovation platforms, trainings, farmer field and business schools, fact sheets.
Critical/essential factors for successful promotion	Ownership of smart phones and/or computers – internet Level of education and customer care experience to attract and maintain online customers Actual product and service quality that matches marketed quality Availability/adequate supply of rice products and services Availability of reliable delivery pathway for products to customers
Partners/stakeholders for scaling up and their roles	Farmers – Sellers of unmilled rice County extension staff - Capacity building NGOs – Capacity building Agripreneurs-providing linkages between farmers and other partners Private sector (local traders, and exporters) – Buyers of rice and by-products Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Kirinyaga, Busia, Migori, Homa Bay, Kisumu, Elgeyo Marakwet, Baringo, Uasin Gishu, Garissa, Tana River, Taita Taveta, Siaya, Tharaka Nithi, Lamu, Kilifi, Kwale, West Pokot,

	Trans Nzoia, Bungoma, Kakamega, Vihiga, Narok, Nyeri, Muranga, Meru, Embu
Challenges in development and dissemination -	• Lack of rice innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low digital skills among rice farmers and service providers • Individual marketing resulting in periods of insufficient quantities • Lack of collective action in digital marketing • Inadequate information to stakeholders on the rice production, marketing and profitability • Limited internet connectivity • Levels of policy support on internet infrastructure
Suggestions for addressing the challenges	• Establish rice innovation platforms, • Capacity building and involvement of youth in digital marketing • Collective action and delivery of produce to the designated centres, • Sensitization to appreciate need for consolidation of produce, developing of information hubs, • Policy support – opportunities are available like the wi-fi hotspots to markets.
Lessons learned in upscaling if any	
Social, environmental, policy and market conditions necessary for development and up-scaling	• Social – Adherence to quality and quantity presented on the digital platform • Environmental – Suitable land and irrigation infrastructure for expansion of rice production; Internet integration to the rural areas • Market – Expanding markets for rice with various brands available.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of internet wifi per month for digital market at approximately KES.2,000
Estimated returns	Ability to sell produce at higher prices
Gender issues and concerns in development and dissemination, adoption and scaling	• Women have less access and interest in use of digital marketing tools such as phones and computer. • Digital marketing will require delivery of produce to far away markets which may be a challenge for women and men • Women are more illiterate and therefore cannot use the ICTs compared with men.
Gender related opportunities	• Opportunities exist for youth to use the ICT tools since most of them are highly literate and have the phones or the computer. • Opportunities for youth in transport and delivery of products sold through digital marketing
VMG issues and concerns in development and	• VMGs have less access to the required tools such as phones and computer.

dissemination, adoption and scaling up	• VMGs are more illiterate and therefore have limited use of ICTs
VMG related opportunities	Opportunities exist for VMGs to use the ICT tools to market their produce hence granting them access to markets previously not accessed
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	Training manuals and fact sheets
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	2 – Requires validation
G: Contacts	
Contacts	The Centre Director, ICRC Mwea P.O. Box 298, Kerugoya Email: kalro.mwea@kalro.org Phone: +254 20 2028217; +254 111 010100
Lead organization and scientists	KALRO ICT, KALRO Mwea
Partner organizations	traders, agripreneurs,, processors, farmer cooperatives

2.15 AGRICULTURAL POLICY OPTIONS

2.15.1 National Rice Development Strategy II (NRDS)

2.15.1. TIMP Name	**National Rice Development Strategy II (NRDS)**
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Inadequate rice supply. The increase in the demand for rice in the past decade has led to a rice deficit, which has been met through imports, hence causing high import bills.
What is it? (TIMP description)	NRDS II seeks to lower the import bill resulting from rice importation through expansion of area under rice production and increasing productivity based on the identified TIMPs.
Justification	The increased demand in rice is linked to the changing eating behavior and increased population, particularly among the youths (main consumers). As a result, there is need for increased productivity; however, there are various challenges experienced by the actors, which include high cost of production, lack or poor access to inputs, high harvest and post-harvest losses, lack of credit facilities, erratic weather conditions, poor market linkage and infrastructure, and low rice value addition technologies. As a

	result, NRDS II will enhance development and dissemination of improved production technologies, upscaling mechanization, efficient irrigation water management, introduction of high yielding rice varieties, and improved technologies on harvest, post-harvest handling and value addition.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Rice Irrigation Scheme • Extension officers • Small-scale farmers • Large-scale farmers • Food processors • Research Institutions • Agripreneurs
Approaches to be used in dissemination	• Farmer field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Extension publications • On-farm demonstrations, field days and farmer trainings • Agricultural shows and exhibitions as well as farmer to farmer training • On-farm and on-station research trails/ demonstrations • Training workshops, Seminars, Meetings • Agricultural shows • MoA/Extension officers • Farmer to farmer extension models • Mass media – Agricultural programs (Radio, TV, newspapers) • Publications (posters/brochures/leaflets/pamphlets, manuals, factsheets) • Digital platforms (Apps, websites, social media)
Critical/essential factors for successful promotion	• Regular sensitization of the NRDS II • Good interrelation among value chain actors. • Dissemination of identified TIMPs
Partners/stakeholders for scaling up and their roles	• Research and extension – Sensitize stakeholders and disseminated technologies. • National and county government to ensure dissemination of improved production technologies Farmers: To adopt NRDS II
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Counties where TIMPs will be up scaled	Busia, Kisumu, Siaya
Challenges in development and dissemination -	• Limited implementation of planned activities and TIMPs • Poor infrastructure on technology dissemination • Inadequate extension agents, agripreneurs,' familiar with local dialects of target areas • Availability of extension agents, agripreneurs, to train farmers during rice cropping calendar

	• Availability of labour required for use in implementation
Suggestions for addressing the challenges	• Increased funding from government and public-private partnerships • Develop packages on rice technologies for dissemination using various platforms • Strengthen the extension framework.
Lessons learned in upscaling if any	• A ready market for locally produced rice. Mwea Rice Growers Multipurpose Cooperative Society (MRGM) have benefited through organized rice farming, where the Government through Kenya National Trading Corporation (KNTC) purchases the rice.
Social, environmental, policy and market conditions necessary for development and up-scaling	• Seeding will be socially acceptable (particularly to the women and youth who form the labour force in rice production) in the target communities. • There will be available labour during seeding • Environmental conditions will be favourable for crop growth during upscaling activities for direct seeding of rice. • Policy environment will be enabling for upscaling of the TIMP • The market will be willing and able to absorb the extra produce arising from the increased yields.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development and dissemination, adoption and scaling	• Inadequate representation of youth and women in the policy development process of NRDS II, • Inadequate representation of youth and women in the policy validation process.
Gender related opportunities	• Opportunities exist for women and youths to participate in the policy cycle since the constitution supports their participation • Adequate opportunities exist for youth and women representation in the NRDS II formulation and validation process
VMG issues and concerns in development and dissemination, adoption and scaling up	• Inadequate representation of VMGs in the development process of the process of the NRDS II • Inadequate representation of VMGs in process of NRDS II validation process.
VMG related opportunities	• Opportunities exist for VMGs to participate in implementation of the process of NRDS II since the constitution supports their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mwea Rice Growers Multipurpose Cooperative Society (MRGM) have benefited through organized rice farming, where the Government through Kenya National Trading Corporation (KNTC) purchases the rice hence creating market for locally produced rice.
Application guidelines for users	Training, manuals and factsheets
F: Status of TIMP Readiness (1. Ready for upscaling, 2,	Ready for upscaling

Requires validation, 3. Requires further research)	
G: Contacts	
Contacts	Centre Director, KALRO Mwea Tebere P.O. Box 298-10300, Kerugoya, Kenya Tel: +254 0202028217 E-mail: Kalro.Mwea@kalro.org cd.mwea@kalro.org
Lead organization and scientists	Elias Kamau; John Wambua
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

2.15.2 Policy options and objectives related to Rice farming

1.15.2. TIMP Name	**Policy options and objectives related to Rice farming**
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	High demand and low rice supply. Despite numerous efforts by the government, researchers and extension to develop strategies and technologies, the rice demand surpasses its supply hence there is gap in policy options and opportunities to aid in improving rice production in Kenya.
What is it? (TIMP description)	There are 4 major policy option and objectives that need address to realize the full potential of rice in Kenya, they include 1) Technical issues, 2) Farm inputs 3) Credit support 4) Marketing structure improvement.
Justification	Rice is the third most important crop in Kenya, as a result, existing policy documents; such as Vision 2030, Agricultural Sector Transformation and Growth Strategy (ASTGS), National Food and Nutrition Security Policy (NFNSP) and National Rice Development Strategy II (NRDS) have developed guides to aid in the promotion of the sector; however, the supply does not match the demand. As a result, there is need for more policy options (Above 4) that will lead to self-sufficiency and import substitution. • Technical issues: There is need to develop policies that promote capacity building activities for researchers, extension and farmers on modern rice production technologies, hence strengthen rice research and development institutions. • Farm inputs: There is need to develop policies that increase accessibility to affordable farm inputs and researchers to develop varieties adopted to current climate demands • Credit support: Policies should be developed with an aim of providing adequate finance to value actors, such as agro-dealers, farmers, millers, processors and off-takers • Marketing structure improvement: Policies options should promote and enhance private sector participation in rice marketing and adoption of value addition opportunities.

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Small scale farmers • Large scale farmers • Food processors • Researchers • Agro-dealers • Agripreneurs • Input suppliers • Policy makers • Financial Institution
Approaches to be used in dissemination	• Farmer field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Extension publications • On-farm demonstrations, field days and farmer trainings • Agricultural shows and exhibitions as well as farmer to farmer training • On-farm and on-station research trails/ demonstrations • Training workshops, Seminars, Meetings • Agricultural shows • MoA/Extension officers • Farmer to farmer extension models • Mass media – Agricultural programs (Radio, TV, newspapers) • Publications (posters/brochures/leaflets/pamphlets, manuals, factsheets) • Digital platforms (Apps, websites, social media)
Critical/essential factors for successful promotion	Policy makers willingness to diversify on other options.
Partners/stakeholders for scaling up and their roles	• Policy makers: To develop and implement the policies options. • Farmers – beneficiaries of policy option • County extension staff - Sensitization of farmers • Private sector (local traders, and exporters) – beneficiaries of the policy options • Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Counties where TIMPs will be up scaled	Kirinyaga, Kisumu, Siaya and Busia
Challenges in development and dissemination -	• Inadequate funding to develop the policy option and objectives in rice farming • Inadequate extension agents, agripreneurs,' familiar with local dialects of target areas • Availability of extension agents, agripreneurs, to train farmers during rice cropping calendar • Availability of labour required for use in implementation
Suggestions for addressing the challenges	Increased capitation by government for the development and implementation of policy options.

Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and up-scaling	• Seeding will be socially acceptable (particularly to the women and youth who form the labour force in rice production) in the target communities. • There will be available labour during seeding • Environmental conditions will be favourable for crop growth during upscaling activities for direct seeding of rice. • Policy environment will be enabling for upscaling of the TIMP • The market will be willing and able to absorb the extra produce arising from the increased yields
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development and dissemination, adoption and scaling	• Inadequate representation of youth and women in policy development forums at all levels. • Inadequate representation of youth and women in the policy of validation process.
Gender related opportunities	Opportunities exist for adequate youth and women representation in the policy formulation and validation process
VMG issues and concerns in development and dissemination, adoption and scaling up	• Inadequate representation of VMG in policy development forums at all levels. • Inadequate representation of VMG in the policy validation process
VMG related opportunities	Adequate opportunities exist for VMG representation in the policy formulation and validation process if they focus and strategize well.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training manuals and factsheets
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Requires validation
G: Contacts	
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Lead organization and scientists	KALRO; Elias Kamau; John Wambua
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

2.15.3 Instruments of policy related to Rice

1.15.3. TIMP Name	Instruments of policy related to Rice
Category (i.e. technology, innovation or management practice)	Management Practices
A: Description of the technology, innovation or management practice	
Problem addressed	Low rice productivity due to the existing policy instruments which fail to support the smallholder farmers' issues in rice production and marketing. Therefore, weak policy instruments have led to the market failure for both inputs and output
What is it? (TIMP description)	The policy instruments are the means to achieve policy objectives. For the rice production, some of the policy instruments include subsidy in the inputs and also minimum price for the rice outputs
Justification	Without policy instruments, the rice productivity will remain low. It is very likely that a particular policy instrument, although designed to have primarily an efficiency, distributive, or stability effect, will also have some impact on the other objectives related to rice production
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Traders, agripreneurs, • Processing industries • Extension • NGOs • Research institutions • Policy makers
Approaches to be used in dissemination	• Farmer field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Extension publications • On-farm demonstrations, field days and farmer trainings • Agricultural shows and exhibitions as well as farmer to farmer training • On-farm and on-station research trails/ demonstrations • Training workshops, Seminars, Meetings • Agricultural shows • MoA/Extension officers • Farmer to farmer extension models • Mass media – Agricultural programs (Radio, TV, newspapers) • Publications (posters/brochures/leaflets/pamphlets, manuals, factsheets) • Digital platforms (Apps, websites, social media)
Critical/essential factors for successful promotion	Availability of policy objectives and policy instruments
Partners/stakeholders for scaling up and their roles	• Farmers – beneficiaries of policy instruments • County extension staff - Sensitization of farmers • NGOs – Sensitization of farmers • Research institutions – Sensitization of stakeholders

C: Current situation and future scaling up	
Counties where already promoted if any	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Counties where TIMPs will be up scaled	Kirinyaga, Kisumu, Siaya and Busia
Challenges in development and dissemination -	• Inadequate information to stakeholders on the agricultural policies whether National or in the County • Inadequate extension agents, agripreneurs,' familiar with local dialects of target areas • Availability of extension agents, agripreneurs, to train farmers during rice cropping calendar • Availability of labour required for use in implementation
Suggestions for addressing the challenges	Sensitization of stakeholders
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and up-scaling	• Environmental conditions will be favourable for crop growth during upscaling activities for rice production. • Policy environment will be enabling for upscaling of the TIMP • The market minimum price will be able to cover production costs, • The market will be willing and able to absorb the extra produce arising from the increased yields
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development and dissemination, adoption and scaling	• Inadequate representation of youth and women in policy development forums at all levels. • Inadequate representation of youth and women in the policy of validation process.
Gender related opportunities	Adequate opportunities exist for youth and women representation in the policy formulation and validation process
VMG issues and concerns in development and dissemination, adoption and scaling up	• Inadequate representation of VMGs in policy development forums at all levels. • Inadequate representation of VMGs in the policy of validation process.
VMG related opportunities	Opportunities exist for VMGs participation in all levels of policy formulation since there are policy frameworks to support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training manuals and factsheets
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Requires validation

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2.15.4 Policy cycle for policy issues and implementation

1.15.4. TIMP Name	Policy cycle for policy issues and implementation
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Poor co-ordination in rice business and market channels leads to low competitiveness of rice and its products in markets. Through policy cycle implementation, the co-ordination will be enhanced.
What is it? (TIMP description)	Policy implementation should ensure coherence, coordination and integration in rice business and marketing particularly, the cycle has 5 steps, which include; (1) inception and raising awareness about the implementation process (2) policy and institutional mapping (3) analysis of key agricultural policies and Programmes (4) validation workshop (5) high-level policy dialogue
Justification	Available information points to lack of coordination in rice farming leading to market failure and low productivity. Therefore, a policy cycle (support tool) aid in the coordination of the policy by: (i) promoting a participatory approach to policy analysis, facilitating open dialogue among stakeholders; (ii) identifying policy areas that have the strongest potential to influence coherence, coordination and integration (iii) recognizing that coordination should be considered at all stages of the policy cycle: problem analysis, policy formulation, definition of policy goals and impact indicators, budgeting, capacity development of relevant actors, monitoring and evaluation, and policy adaptation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Small scale farmers • Agripreneurs • Large scale farmers • Food processors/millers • Consumers • Policy makers • Stakeholders
Approaches to be used in dissemination	• Farmer field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Extension publications

	• On-farm demonstrations, field days and farmer trainings • Agricultural shows and exhibitions as well as farmer to farmer training • On-farm and on-station research trials/ demonstrations • Training workshops, Seminars, Meetings • Agricultural shows • MoA/Extension officers • Farmer to farmer extension models • Mass media – Agricultural programs (Radio, TV, newspapers) • Publications (posters/brochures/leaflets/pamphlets, manuals, factsheets) • Digital platforms (Apps, websites, social media)
Critical/essential factors for successful promotion	Availability of policy options, availability of rice policy
Partners/stakeholders for scaling up and their roles	• Government: To provide a platform and facilitate the implementation of the cycle. • Farmers, Processors and consumers: To participate in the policy cycle implementation • Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Counties where TIMPs will be up scaled	Kirinyaga, Kisumu, Siaya and Busia
Challenges in development and dissemination -	• Low capacity to mobilize stakeholders • Weak strength in marketing channels • Inadequate information to stakeholders on the agricultural policies whether National or County • Inadequate extension agents, agripreneurs,' familiar with local dialects of target areas • Availability of extension agents, agripreneurs, to train farmers during rice cropping calendar • Availability of labour required for use in implementation
Suggestions for addressing the challenges	• Involvement of the county governments, farmers, processors, distributor and consumers • Capacity building stakeholders in chain • Sensitization of stakeholders
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and up-scaling	• Environmental conditions will be favourable for crop growth during upscaling activities . • Policy environment will be enabling for increased rice production • The market will be willing and able to absorb the extra produce arising from the increased yields
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not determined

Estimated returns	Not determined
Gender issues and concerns in development and dissemination, adoption and scaling	• Inadequate representation of youth and women in the policy of validation process. • Inadequate representation of youth and women in policy development forums at all levels.
Gender related opportunities	• Adequate opportunities exist for youth and women representation in the policy formulation and validation process.Awareness of the opportunities needs to be created.
VMG issues and concerns in development and dissemination, adoption and scaling up	• Inadequate representation of VMG in the policy of validation process. • Inadequate representation of VMG in policy development forums at all levels.
VMG related opportunities	Opportunities exist for VMGs participation in all levels of policy formulation since there are policy frameworks to support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training manuals and factsheets
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Ready for upscaling
G: Contacts	
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Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

2.15.5 Policy validation cycle for policy customization

2.15.5. TIMP Name	Policy validation cycle for policy customization
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low rice productivity and poor market coordination are linked to poor validation, monitoring and evaluation of the existing policies. Therefore, there is need for adequate policy validation process for effective customization.
What is it? (TIMP description)	Policy validation cycle evaluates the policy progress in reaching its intended results; besides, it assesses whether the intervention was worthwhile and provides evidence for future policymaking. There are 4 steps in evaluation, which include 1) planning 2) designing 3) data collection and analysis 4) Reporting
Justification	Without policy validation the rice productivity and marketing linkages will remain low. It is very likely that a particular policy, although designed to have primarily an efficiency, distributive, or stability effect, will also have some impact on the other objectives related to rice production. Therefore, it is necessary for validation of the policy, particularly; • Planning: Identify the data to be collected • Designing: The process of data collection • Data collection and analysis: Expose whether the results are as expected or the causes for delays • Reporting: Results distribution.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Small scale farmers • Agripreneurs • Large scale farmers • Food processors • Consumers • Policy makers • Stakeholders
Approaches to be used in dissemination	• Farmer field and Business School (FFPS) • Agricultural innovation platforms (AIP) • Extension publications • On-farm demonstrations, field days and farmer trainings • Agricultural shows and exhibitions as well as farmer to farmer training • On-farm and on-station research trails/ demonstrations • Training workshops, Seminars, Meetings • Agricultural shows • MoA/Extension officers • Farmer to farmer extension models • Mass media – Agricultural programs (Radio, TV, newspapers) • Publications (posters/brochures/leaflets/pamphlets, manuals, factsheets) • Digital platforms (Apps, websites, social media)

Critical/essential factors for successful promotion	Availability of policy options, availability of rice policy
Partners/stakeholders for scaling up and their roles	• Government: To provide a platform and facilitate the implementation of the cycle. • Farmers, Processors and consumers: To participate in the policy cycle implementation • Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay Isiolo, Kakamega, Kilifi, Kirinyaga, Kisumu, Kwale, Lamu, Meru, Migori, Muranga, Narok, Nyeri, Siaya, Taita-Taveta, Tana-River, Tharaka-Nithi and West-Pokot
Counties where TIMPs will be up scaled	Kirinyaga, Kisumu, Siaya and Busia
Challenges in development and dissemination -	• Low capacity to mobilize stakeholders • Weak strength in marketing channels • Inadequate information to stakeholders on the agricultural policies whether National or County • Inadequate extension agents, agripreneurs,' familiar with local dialects of target areas • Availability of extension agents, agripreneurs, to train farmers during rice cropping calendar
Suggestions for addressing the challenges	• Involvement of the county governments, farmers, processors, distributor and consumers • capacity building stakeholders in chain • Sensitization of stakeholders
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and up-scaling	• Environmental conditions will be favourable for crop growth during upscaling activities for rice production. • Policy environment will be enabling for upscaling of the TIMP • The market will be willing and able to absorb the extra produce arising from the increased yields
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development and dissemination, adoption and scaling	• Inadequate representation of youth and women in the policy of validation process. • Inadequate representation of youth and women in policy development forums at all levels.
Gender related opportunities	Adequate opportunities exist for youth and women representation in the policy formulation and validation process
VMG issues and concerns in development and dissemination, adoption and scaling up	• Inadequate representation of VMG in the policy of validation process. • Inadequate representation of VMG in policy development forums at all levels.
VMG related opportunities	Opportunities exist for VMGs participation in all levels of policy formulation since there are policy frameworks to support their participation

E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training manuals and factsheets
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Ready for upscaling
G: Contacts	
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