

INVENTORY OF CLIMATE SMART AGRICULTURE TECHNOLOGIES, INNOVATIONS AND MANAGEMENT PRACTICES FOR COWPEA VALUE CHAIN



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DISCLAIMER

The information presented in this inventory of 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 agroclimatic zones from their area agricultural extension officers.

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FOREWORD

The National Agricultural and Rural Inclusive Growth Project (NARIGP) tasked the Kenya Agricultural and Livestock Research Organization (KALRO) to develop and deliver context specific Technologies, Innovation and Management Practices (TIMPs) that can be deployed in climate smart agriculture interventions). This document provides a detailed inventory of TIMPs that have been developed in Cowpea value chain.

Extensive information from research and background data has been reviewed to help in development of this 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 all aspects of the TIMPs are fully covered in a 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. This TIMPs inventory is therefore to be used in conjunction with the respective Cowpea ToT Manual. The adoption and use of this TIMPs inventory is expected to contribute to increased productivity and profitability for improved incomes.

I am greatly indebted to the value chain experts and all those who participated in the preparation of this inventory of TIMPs document. 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 and Rural Inclusive Growth Project (NARIGP) is funded by the Government of Kenya and the World Bank. The project runs for five years and is implemented in 21 Counties in the country at an approximate cost of KES 22 billion. The project development objective (PDO) is “*To increase agricultural productivity and profitability of targeted rural communities in selected Counties, and in the event of an Eligible Crisis or Emergency, to provide immediate and effective response.*” To achieve the objective, the project is promoting adoption of climate smart agricultural Technologies, Innovations and Management Practices (TIMPs).

The project comprises of four (4) components: Component 1 involves strengthening (i) community-level institutions’ ability to identify and implement investments that improve their agricultural productivity, food security and nutritional status, and (ii) linkages to selected value chains and producer organizations. Component 2 deals with strengthening producer organizations and value chains development by building capacity to support members of targeted rural communities, which include Common Interest Groups (CIGs) and Vulnerable and Marginalized Groups (VMGs). Component 3 undertakes strengthening the capacity of County governments to support community-led development initiatives identified under Components 1 and 2. Component 4 is on project coordination, management, monitoring and evaluation.

Kenya Agricultural and Livestock Research Organization (KALRO) in conjunction with partners in the National Agricultural Research Systems (NARS) and Consultative Group for International Agricultural Research (CGIAR) compiled inventories of TIMPs of prioritized value chains as an initial step towards promotion of their adoption. Of these, 13 are crop-based. They include roots and tubers (potato and sweetpotato); pulses (bean, green gram and cowpea); vegetables (tomato and indigenous vegetables); cereals (sorghum), nuts (macadamia and coconut) and fruits (banana, mango and avocado). The four (4) animal production-based value chains are apiculture, indigenous chicken (meat and eggs), dairy (cattle) and red meat (sheep and goats). In addition, there are three (3) cross cutting themes on pastures and fodder, natural resource management, and animal health.

The TIMPs were categorized into those ready for up scaling and those requiring validation. In addition, gaps that required further research were identified for subsequent development of TIMPs. This *manual focuses on TIMPs that are ready for upscaling Cowpea value chain. It should be used in training County extension staff, service providers, community based facilitators and lead farmers. Those trained are expected to cascade the training to beneficiaries in the targeted smallholder farming, agro-pastoral and pastoral communities in the 21 project Counties of Kirinyaga, Kiambu, Murang’a, Nakuru, Bungoma, Trans Nzoia, Nandi, Vihiga, Kisii, Nyamira, Migori, Homa Bay, Makueni, Meru, Kitui, Embu, Kilifi, Kwale, Narok, Samburu and Turkana.*

The National Project Coordination Unit is grateful to all who participated in the development and production of this manual for the Cowpea value chain. It is my hope that Counties and other users will adopt and optimally use the manual to increase productivity and profitability, which in the overall will improve the livelihood of the targeted farming communities.

John Kimani

National Project Coordinator

National Agricultural Rural and Inclusive Growth Project

ABBREVIATIONS AND ACRONYMS

AAK	Agrochemical Association of Kenya
AEZ	Agroecological Zone
AFA	Agriculture and Food Authority
AGRA	Alliance for Green revolution in Africa
AIP	Agricultural Innovation Platforms
ASALs	Arid and Semi-Arid Lands
CBO	Community Based Organisation
CGIAR	Consultative Group for International Agricultural Research
CIG	Common Interest Group
FAO	Food and Agriculture Organisation
FBO	Farmer Based Organization
FFBS	Farmer Field and Business School
FFS	Farmer Field School
FSMS	Food Safety Management System
GAP	Good Agricultural Practices
GHG	Green House Gas
HACCP	Hazard Analysis Critical Control Points
ICRAF	International Centre for Research in Agroforestry (World Agroforestry Centre)
IMM	Integrated Manure Management
IPM	Integrated Pest Management
iSDA	Innovative Solution for Decision Agriculture
ISFM	Integrated Soil Fertility Management
KALRO	Kenya Agricultural and Livestock Research Organization
KEBS	Kenya Bureau of Standards
KEPHIS	Kenya Pant Heath Inspectorate Service
MoALFC	Ministry of Agriculture, Livestock, Fisheries and Cooperatives
NARIGP	National Agricultural and Rural Inclusive Growth Project
NGO	Non-Governmental Organization
PCPB	Pest Control Products Board
TIMPs	Technologies, Innovation and Management Practices
ToT	Training of Trainer
USAID	United States Agency for International Development
VMG	Vulnerable and Marginalized Group

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1. DEFINITION OF TERMS AND SUMMARY TABLES OF COWPEA TECHNOLOGIES, TECHNOLOGIES, INNOVATIONS AND MANAGEMENT PRACTICES (TIMPs)

2.4.2 Definition of terms

Technology: This is an output of a research process which is beneficial to the target clientele (mainly farmers for NARIGP'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).

1.1.1. Summary of Inventory of TIMPs in the Cowpea value chain

The inventory process identified **113** TIMPs comprising **41** technologies, **20** innovations and **52** management practices, distributed among the sub-themes, as indicated in Table 1.

Table 1 Summary of Cowpea TIMPs

Commodity value chain	Sub-theme	Technologies	Innovations	Management practices
Cowpea	Improved Cowpea varieties	15	0	0
Cowpea	Cowpea seed system	1	1	0
Cowpea	GAPs and Food Safety	0	0	2
Cowpea	Agronomic Management Practices	0	0	5
Cowpea	Soil Fertility Management	2	1	0
Cowpea	Soil and Water Management	1	0	8
Cowpea	Cowpea Crop Health	5	1	19
Cowpea	Postharvest Management	4	0	3
Cowpea	Cowpea Value Addition	4	16	0
Cowpea	Mechanization of Cowpea production activities	9	1	
Cowpea	Cowpea Business and Marketing	0	0	9
Cowpea	Agricultural policy	0	0	6
Total		41	20	52

1.1.2. Summary of status of TIMPs in Cowpea value chain

The inventory process resulted in a total of **75** TIMPs that are ready for upscaling, **34** TIMPs that require validation and **3** 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	Require validation	Requires further research
Cowpea	Improved Cowpea varieties	10	5	0
Cowpea	Cowpea seed system	1	1	0
Cowpea	GAPs and food safety	2	0	0
Cowpea	Agronomic management practices	5	0	0
Cowpea	Soil Fertility Management	2	1	0
Cowpea	Soil and Water Management	8	0	1
Cowpea	Cowpea Crop health	18	7	0
Cowpea	Postharvest management	7	0	0
Cowpea	Cowpea value addition	10	10	0
Cowpea	Mechanization of Cowpea production activities	7	2	1
Cowpea	Cowpea business and marketing	5	3	1
Cowpea	Agricultural policy	0	5	0
Overall total		75	34	3

1.1.3. Inventory of Cowpea TIMPs by category and status

Table 3 Inventory of Cowpea TIMPs by category and status

TIMPs sub-theme	TIMPs title	TIMPs category	Status
2.1 Improved Cowpea varieties	Dual Purpose Cowpea		
	2.1.1 Kunde Tumaini	Technology	Require validation
	2.1.2 Kunde Faulu	Technology	Require validation
	2.1.3 Kat Kunde	Technology	Require validation
	2.1.4 Kunde Soko	Technology	Require validation
	2.1.5 Kunde Tamu	Technology	Require validation
	2.1.6 M66	Technology	Ready for upscaling
	2.1.7 K80	Technology	Ready for upscaling
	2.1.8 KVVU27-1	Technology	Ready for upscaling
	2.1.9 KVVU419	Technology	Ready for upscaling
	2.1.10 Kenya Kunde	Technology	Ready for scaling
	Vegetable type		
	2.1.11 Kunde Mboga	Technology	Ready for upscaling
	2.1.12 Usimpe Mtu Mdgo	Technology	Ready for upscaling
	2.1.13 Sura Mbaya	Technology	Ready for upscaling
	2.1.14 Katsetse	Technology	Ready for upscaling
	2.1.15 Mnyenze Madamada	Technology	Ready for upscaling
2.2 Cowpea Seed System	2.2.1. Cowpea Informal seed system	Innovation	Require validation
	2.2.2. Cowpea formal seed system	Technology	Ready for upscaling
2.3 Good Agricultural Practices and Food Safety Management Systems	2.3.1 Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) plan for Cowpea value chain in Kenya	Management practice	Ready for upscaling
	2.3.2 Good Agricultural Practices (GAPs) for Cowpea.	Management practice	Ready for upscaling
2.4 Agronomic Management Practices	2.4.1 Land preparation	Management practice	Ready for upscaling
	2.4.2 Crop spacing	Management practice	Ready for upscaling
	2.4.3 Fertilizer/manure application	Management practice	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.4.4 Crop rotation for increased yields	Management practice	Ready for upscaling
	2.4.5 Intercropping	Management practice	Ready for upscaling
2.5 Soil Fertility Management	2.5.1 Integrated Manure Management	Technology	Requires upscaling
	2.5.2 Integrated Soil Fertility Management	Technology	Requires validation
	2.5.3 Rapid Soil Testing Services	Innovation	Requires validation
2.6 Soil and Water Management	2.6.1 Contour bands	Management practice	Ready for upscaling
	2.6.2 Zai Pits	Management practice	Ready for upscaling
	2.6.3 Bench terraces	Management practice	Ready for upscaling
	2.6.4 Fanya juu terraces	Management practice	Ready for upscaling
	2.6.5 Stone lines	Management practice	Ready for upscaling
	2.6.6. Grass strips	Management practice	Ready for upscaling
	2.6.7. Tied ridges	Management practice	Ready for upscaling
	2.6.8 Conservation Agriculture	Management practice	Ready for upscaling
	2.6.9 Cowpea/ cereal intercropping	Technology	Require further research
2.7 Cowpea Crop Health	2.7.1 Integrated Management of Stem maggots on Cowpea	Management practice	Ready for upscaling
	2.7.2 Integrated management of Blister beetle on cowpea flowers	Management practice	Ready for upscaling
	2.7.3 Integrated Management of African Bollworm, <i>Helicoverpa spp.</i> on Cowpea	Management Practice	Ready for upscaling
	2.7.4 Integrated management of Thrips, <i>Frankliniella spp</i>) on Cowpea	Management practice	Ready for upscaling
	2.7.5 Integrated management of Cutworms on Cowpea	Management practice	Ready for upscaling
	2.7.6 Integrated Pest Management of Aphids on Cowpea.	Management Practice	Ready for upscaling
	2.7.7 Integrated	Management practice	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	Management of Maruca pod borer on Cowpea		
	2.7.8 Integrated management of Rust on Cowpea	Management practice	Ready for upscaling
	2.7.9 Integrated pest management (IPM) of Anthracnose (Collectotrichum spp) on Cowpea	Management practice	Ready for upscaling
	2.7.10 Integrated management of Powdery Mildew (Oidium polygoni)	Management practice	Ready for upscaling
	2.7.11 Integrated Management of halo blight and bacterial leaf blight disease of Cowpeas	Management practice	Ready for upscaling
	2.7.12 Integrated management of Leaf spots on Cowpea	Management practice	Ready for upscaling
	2.7.13 Integrated Management of root rot and Fusarium wilt diseases of Cowpea	Management practice	Ready for upscaling
	2.7.14 Integrated Management of Cowpea Mosaic Virus disease	Management practice	Ready for upscaling
	2.7.15 Integrated Management of Root knot Nematodes on Cowpea	Management practice,	Ready for upscaling
	2.7.16 Cowpea Integrated Weed Management (IWM)	Management Practice	Requires validation
	2.7.17 Cowpea Intercropping System	Management practice	Requires validation
	2.7.18 Cover cropping for Cowpea weed management	Technology	Requires validation
	2.7.19 Mulching for Cowpea weed management	Technology	Ready for up-scaling
	2.7.20 Herbicide (Chemical) Weed Control	Technology	Requires validation

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	in Cowpea		
	2.7.21 Solarization Bed for Weed Control in Cowpea	Technology	Require validation
	2.7.22 Stale seed bed for Weed Control in Cowpea	Technology	Require validation
	2.7.23 Mechanical/ Manual Weed Control in Cowpea	Innovation	Ready for up-scaling
	2.7.24 Crop Rotation for weed control in Cowpea	Management practice	Require validation
	2.7.25 Safe Use of herbicides	Management practice	Ready for up-scaling
2.8 Harvest and postharvest management	2.8.1 Maturity and harvesting methods of Cowpea	Management practice	Ready for upscaling
	2.8.2 Drying of cowpea pods	Management practice	Ready for upscaling
	2.8.3 Threshing and winnowing	Management practice	Ready for upscaling
	2.8.4 Drying of cowpea grain	Technology	Ready for upscaling
	2.8.5 Cowpea grain storage	Technology	Ready for upscaling
	2.8.6 Postharvest handling practices for cowpea leaves	Management practice	Ready for upscaling
	2.8.7 Cooling of cowpea leaves	Technology	Ready for upscaling
2.9 Cowpea value addition	2.9.1 Cowpea flour	Innovation	Require Validation
	2.9.2 Cowpea biscuits	Innovation	Requires validation
	2.9.3 Cowpea chapati	Innovation	Ready for upscaling
	2.9.4 Canned cowpea	Technology	Requires validation
	2.9.5 Cowpea mandazi	Innovation	Ready for upscaling
	2.9.6 Cowpea buns	Innovation	Requires validation
	2.9.7 Cowpea fritters	Innovation	Requires validation
	2.9.8 Cowpea sprouts	Technology	Ready for upscaling
	2.9.9 Cowpea noodles	Innovation	Requires validation
	2.9.10 Cowpea doughnuts	Innovation	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.9.11 Cowpea cake	Innovation	Ready for upscaling
	2.9.12 Cowpea cookies	Innovation	Require validation
	2.9.13 Cowpea vegetables	Innovation	Ready for upscaling
	2.9.14 Cowpea ball	Innovation	Ready for upscaling
	2.9.15 Green cowpea pod	Innovation	Ready for upscaling
	2.9.16 Dehulled cowpea	Innovation	Ready for upscaling
	2.9.17 Dried cowpea leaves	Innovation	Ready for upscaling
	2.9.18 Cowpea weaning food	Innovation	Require validation
	2.9.19 Roasted cowpea	Technology	Require Validation
	2.9.20 Cowpea hay	Technology	Require Validation
2.10 Mechanization of Cowpea production activities	2.10.1 Power tiller	Technology	Ready for upscaling
	2.10.2 Wheeled tractor	Technology	Ready for upscaling
	2.10.3 Mouldboard plough	Technology	Ready for upscaling
	2.10.4 Disk Harrow	Technology	Ready for upscaling
	2.10.5 Cowpea planter	Technology	Ready for upscaling
	2.10.6 Motorized Sprayer	Technology	Ready for upscaling
	2.10.7 Ripper Binder	Technology	Require validation
	2.10.8 Thresher	Innovation	Ready for upscaling
	2.10.9 Combine harvester	Technology	Require validation
	2.10.10 Grader	Technology	Further Research
2.11 Business and Marketing	2.11.1 Smart model for marketing	Management practice	Requires validation
	2.11.2 SWOT Matrix – Strengths, Weaknesses, opportunities and Threats	Management practice	Requires validation
	2.11.3 Products-markets matrix	Management practice	Ready for upscaling
	2.11.4 Pairwise matrix	Management practice	Ready for upscaling
	2.11.5 Farm budgets, farm records, Break-even and gross margins	Management practice	Ready for upscaling
	2.11.6 Market Research	Management practice	Ready for upscaling
	2.11.7 Forming producer organizations	Management practice	Ready for upscaling
	2.11.8 Contract farming	Management practice	Further research

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.11.9 Internet marketing	Management practice	Requires validation
2.12. Agricultural policy options	2.12.1 Agricultural policy framework for making County agricultural policy	Management practice	Require validation
	2.12.2 Mineral fertiliser policy	Management practice	Require validation
	2.12.3 Options in Kenya National Seed Policy 2010 interventions	Management practice	Require validation
	2.12.4 National Agricultural Mechanization Policy 2021 interventions.	Management practice	Require validation
	2.12.5 Kenya Climate smart agricultural policy interventions	Management practice	Require validation
	2.12.6 Policy cycle	Management practice	Require validation
Total TIMPs	113		

2. DETAILED COWPEA VALUE CHAIN TIMPS

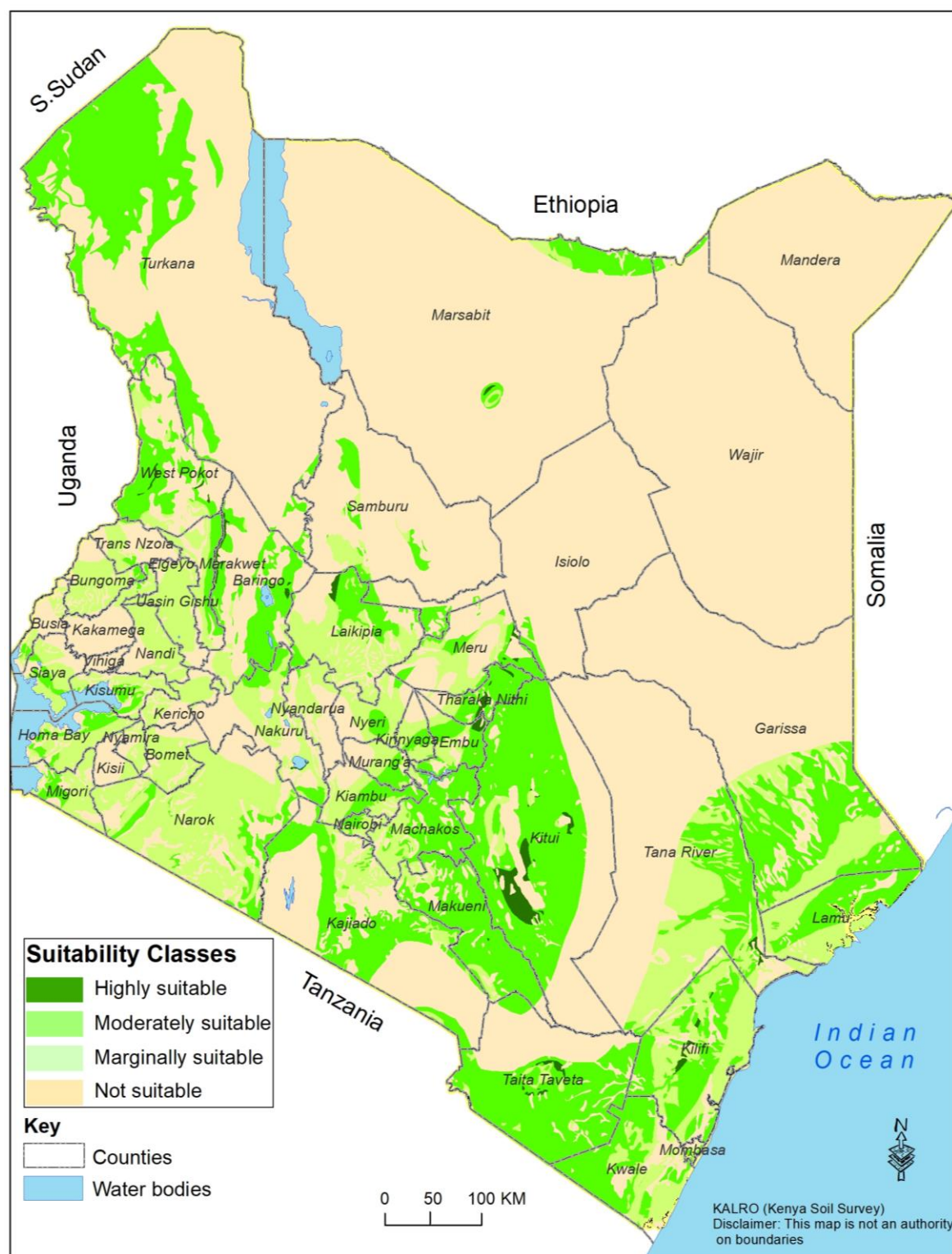




Figure 1: Cowpea growing areas suitability map

2.4.3 IMPROVED COWPEA VARIETIES

2.1.1. Kunde Tumaini

TIMP Name	Kunde Tumaini
Category (i.e. technology, innovation or management practice)	Technology 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yield production due to the parasitic weed <i>Alectra vogelii</i> prevalence in cowpea production areas
What is it? (TIMP description)	It is an <i>Alectra vogelii</i> weed tolerant, early maturing, high yielding (1.5 – 2.2 t ha ⁻¹) large grained cowpea variety with deep brown color. It is highly preferred by farmers good and for market.
Justification	Increased biotic stresses such as parasitic weed prevalence reduces the yield production and quality of cowpea. The variety is resistant to <i>A. vogelii</i> and also high yielding. Increase in agricultural yield translates into decrease in the number of absolute poor households in cowpea producing areas of Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital platforms • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals)Agricultural innovation platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways

	<ul style="list-style-type: none"> • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs for technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties among stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak or non-existent proper market information systems (MIS) • Inaccessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and private seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental,	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economic importance of the variety.


policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Following good management of the crop and land, a yield of 607-890 kg/acre would give an income of KES.36,000 – 53,400/acre and estimated net returns of KES.24,371 – 41,368 per acre in one season.
Gender issues and concerns in development ,dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	Cowpea Training Manual: KALRO-KCEP Training and Extension Manual on Cowpea
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Kuruma R.
Partner organizations	AGRA, USAID, KEPHIS, Farmers

Research gaps


1. Validate the new cowpea varieties in different counties
2. Engage partner organization to support up-scaling of the new varieties
3. Early generation seed production for availability and accessibility

2.1.2. Kunde Faulu

TIMP Name	Kunde Faulu
Category (i.e., technology, innovation or management practice)	Technology -:
A: Description of the technology, innovation or management practice	
Problem to be addressed	Current commercial cowpea varieties are low yielding and are susceptible to <i>Alectra vogelii</i> Parasitic weed
What is it? (TIMP description)	

	The grain is creamy white in color with a brown eye, good for market and highly preferred by farmers. It's late maturing flowering within 50 – 56 days. The variety is a high yielding variety with 1.5 – 2.0 t ha ⁻¹
Justification	Increased biotic stresses such as parasitic weed prevalence reduces the yield production and quality of cowpea. The variety is resistant to <i>A. vogelii</i> with high yielding varieties. Increase in agricultural yield translates into decrease in the number of absolute poor households in the world.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Mobile applications (facebook, twitter, etc) • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIP
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g., Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where	Kitui and Makueni

already promoted if any	
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak a or non-existent proper market information systems (MIS) • In accessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and privates seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the needs to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Following good management of the crop and land, a yield of 607-809 kg/acre would give an income of KES.36,000 – 48,600/acre and estimated net returns of KES.24,371 – 36,511 per acre in one season.



Gender issues and concerns in development, dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets

Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Brochures</p> <ul style="list-style-type: none"> • Cowpea new varieties brochures • Cowpea growing brochures
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up scaling
G. Contacts	
Contacts	<p>Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org</p>
Lead organizations and scientists	KALRO, Kuruma R.
Partner organizations	AGRA, USAID, KEPHIS, Farmers


Research gaps

1. Validate the new cowpea varieties in different counties
2. Engage partner organization to support up-scaling of the new varieties
3. Early generation seed production for availability and accessibility

2.1.3. Kat- Kunde

TIMP Name	Kat- Kunde
Category (i.e., technology, innovation management practice) or	Technology <div>   </div>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yield production due to the parasitic weed <i>Alectra vogelii</i> prevalence in cowpea production areas
What is it? (TIMP description)	It is an <i>Alectra vogelii</i> tolerant, high yielding (1.5 – 2.0 t ha ⁻¹) large grained cowpea variety, creamy white in color with a brown eye. It is late maturing (flowering within 50 – 56 days) but is good for market and highly preferred by farmers.
Justification	Increased biotic stresses such as parasitic weed prevalence reduces the yield production and quality of cowpea. The variety is resistant to <i>A. vogelii</i> and also high yielding. Increase in agricultural yield translates into decrease in the number of absolute poor households in the world
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital platforms • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Promotional materials (posters/brochures/leaflets, manuals) • AIPs
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market

	<ul style="list-style-type: none"> • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak a or non-existent proper market information systems (MIS) • In accessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and privates seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and

conditions necessary for development and up scaling	<p>marketing as it is mainly cultivated by women hence the need to build their capacity.</p> <ul style="list-style-type: none"> • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Following good management of the crop and land, a yield of 607-809 kg/acre would give an income of KES.36,000 – 48,600/acre and estimated net returns of KES.24,371 – 36,511 per acre in one season.
Gender issues and concerns in development, dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Brochures</p> <ul style="list-style-type: none"> • Cowpea new varieties brochures • Cowpea growing brochures
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	<p>Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org</p>
Lead organizations and scientists	KALRO, Kuruma R.
Partner organizations	AGRA, USAID, KEPHIS, Farmers

Research gaps

1. Validate the new cowpea varieties in different counties
2. Engage partner organization to support up-scaling of the new varieties
3. Early generation seed production for availability and accessibility

2.1.4. Kunde Soko

TIMP Name	Kunde Soko
Category (i.e., technology, innovation management practice) or	<p>Technology</p> <div>   </div>
A: Description of the technology, innovation or management practice	
Problem to be	Low yield production due to the parasitic weed <i>Alectra vogelii</i> prevalence in

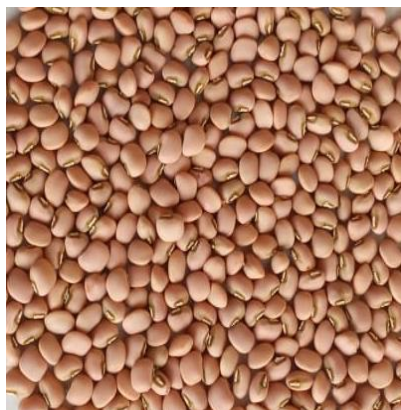

addressed	cowpea production areas
What is it? (TIMP description)	It is an <i>Alectra vogelii</i> tolerant, high yielding (1.5 – 2.0 t ha ⁻¹) but late maturing (flowering within 50 – 56 days) large grained cowpea variety. The seed is creamy white in color with a brown eye, good for market and highly preferred by farmers.
Justification	Increased biotic stresses such as parasitic weed prevalence reduces the yield production and quality of cowpea. The variety is resistant to <i>A. vogelii</i> with high yielding varieties. Increase in agricultural yield translates into decrease in the number of absolute poor households in the world
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital platforms • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIPs
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low-cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions

C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak or non-existent proper market information systems (MIS) • Inaccessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and private seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Following good management of the crop and land, a yield of 607-809 kg/acre would give an income of KES.36,000 – 48,600/acre and estimated net returns of KES.24,371 – 36,511 per acre in one season.

<p>Gender issues and concerns in development, dissemination, adoption and scaling up</p>	<div> </div> <p>Women perform most of the cowpeas production activities such as planting, weeding and harvesting</p> <ul style="list-style-type: none"> • Cow peas are <p>considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men</p> <ul style="list-style-type: none"> • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
<p>Gender related opportunities</p>	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
<p>VMG issues and concerns in development, dissemination, adoption and scaling up</p>	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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
<p>VMG related opportunities</p>	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
<p>E: Case studies/profiles of success stories</p>	
<p>Success stories from previous similar projects</p>	<p>Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets</p>


Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya Brochures <ul style="list-style-type: none"> • Cowpea new varieties brochures • Cowpea growing brochures
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Kuruma R.
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.5. Kunde Tamu

2.1.3: Kunde Tamu	
TIMP Name	Kunde Tamu
Category (i.e. technology, innovation management practice) or	Technology <div></div>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yield production due to <i>Alectra vogelii</i> prevalence in cowpea production areas
What is it? (TIMP description)	It is a high yielding and tolerant line to <i>Alectra vogelii</i> (parasitic weed). The average grain yield is 1.5 – 2.0-ton ha ⁻¹ and weighs around 14.0 g per 100 seeds dry weight.
Justification	Increased biotic stresses such as parasitic weed prevalence reduces the yield production and quality of cowpea. The variety is resistant to <i>A. vogelii</i> and high yielding. Increase in agricultural yield translates into decrease in the number of absolute poor households in the world



B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital platforms • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIPs
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders

dissemination	<ul style="list-style-type: none"> • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak a or non-existent proper market information systems (MIS) • In accessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and privates seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Following good management of the crop and land, a yield of 607-809 kg/acre would give an income of KES.36,000 – 48,600/acre and estimated net returns of KES.24,371 – 36,511 per acre in one season.

Gender issues and concerns in development, dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya


	Brochures <ul style="list-style-type: none"> • Cowpea new varieties brochures • Cowpea growing brochures
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Kuruma R.
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.6. M66 (Dual Purpose variety)

TIMP Name		M66 (Dual Purpose variety)	
Category (i.e., technology, innovation or management practice)		Technology	
			
A: Description of the technology, innovation or management practice			
Problem to be addressed		Non- availability of high yielding commercial varieties	
What is it? (TIMP description)		Variety Machakos 66 (M66) is a dual purpose variety, for both grain and vegetable use. It flowers within 55-60 days after germination and can grow from sea level to 1600 m above sea level (asl). It has a grain yield potential of 1.1 – 1.7 t/ha. Seed color is creamy brown in color with purple tinges	
Justification		Harvest of cowpea leaves as a vegetable as well as grain from the same plant (dual-purpose) is a primary goal for farmers, which allows them to exploit the nutritional benefits of both. The leaves are consumed in a variety of traditional dishes, or dried for use in the dry season while the grains are consumed for different cowpea-based products. From its production, rural families derive food,	


	animal feed and income through the sales of the grain and fresh leaves.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools • Agricultural innovation platforms • Field days • Agricultural shows • Digital platforms • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared

	<p>to self-pollinated crops)</p> <ul style="list-style-type: none"> • Weak a or non-existent proper market information systems (MIS) • In accessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and privates seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Returns from Grain: Following good management of the crop and land, a yield of 445-688 kg/acre would give an income of KES.26,700 – 41,277/acre and estimated net returns of KES.14,659 – 29,227 per acre in one season.


Gender issues and concerns in development, dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Kuruma R.
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.7. K80


TIMP Name	K80 (Dual Purpose variety)
Category (i.e. technology, innovation management practice) or	Technology 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Unavailability of high yielding commercial varieties
What is it? (TIMP description)	Variety Katumani 80 (K80) is a dual purpose (for both grain and vegetable use) cowpea variety. It flowers within 55-60 days after germination and can grow from sea level to 1600 m above sea level (asl). It has a grain yield potential of 1.2 – 1.8 t/ha. Seed color is creamy brown.
Justification	Harvest of cowpea leaves as a vegetable as well as grain from the same plant (dual-purpose) is a primary goal for farmers, which allows them to exploit the nutritional benefits of both. The leaves are consumed in a variety of traditional dishes, or dried for use in the dry season while the grains are consumed for different cowpea based products. From its production, rural families derive food, animal feed and income through the sales of the grain and fresh leaves.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies

Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital Platforms • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIPs
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations–for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak or non-existent proper market information systems (MIS) • In accessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms


	<ul style="list-style-type: none"> Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Develop and disseminate information to the various stakeholders Adequate production of breeder seed and linking to KALRO seed unit and privates seed companies for production of adequate seed for farmers Promote Proper marketing models that encourage collective production and marketing Improve on seed access through the agro-dealer system Establish and strengthen stakeholder innovation platforms and identify the platform leaders Involve county governments, Extension, marketers and processors Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> Creation of awareness on nutritive and economical importance of the variety. Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. Increase public and private dialogue to approve models that will ensure compliance with international standards Provision of improved market information system on volume, quality and supply consistency requirements Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Following good management of the crop and land, a yield of 486-728 kg/acre would give an income of KES.29,000 – 43,700/acre and estimated net returns of KES.17,087 – 31,655 per acre in one season.
Gender issues and concerns in development ,dissemination, adoption and scaling up	 <ul style="list-style-type: none"> Women perform most of the cowpeas production activities such as planting, weeding and harvesting Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men Women have less access to agricultural information, technology and knowledge on cowpeas

	<p>production than men</p> <ul style="list-style-type: none"> • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO- AMRI Katumani, MoALF&I – County governments, Cowpea breeder- Rose Kuruma
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.8. KVVU27-1


TIMP Name	KVVU27-1 (Dual Purpose variety)
Category (i.e. technology, innovation management practice) or	Technology 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Non- availability of high yielding commercial varieties
What is it? (TIMP description)	Variety KVVU 27-1 is a dual purpose (for both grain and vegetable use) cowpea variety. It flowers within 55-60 days after germination and can grow from sea level to 1600 m above sea level (asl). It has a grain yield potential of 1.2 – 1.8 t/ha and the seed is red in color.
Justification	Harvest of cowpea leaves as a vegetable as well as grain from the same plant (dual-purpose) is a primary goal for farmers, which allows them to exploit the nutritional benefits of both. The leaves are consumed in a variety of traditional dishes, or dried for use in the dry season while the grains are consumed for different cowpea based products. From its production, rural families derive food, animal feed and income through the sales of the grain and fresh leaves.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital Platforms • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIPs
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers)

	<ul style="list-style-type: none"> • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak a or non-existent proper market information systems (MIS) • In accessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and privates seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology

Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Following good management of the crop and land, a yield of 486-728 kg/acre would give an income of KES.29,000 – 43,700/acre and estimated net returns of KES.17,087 – 31,655 per acre in one season.
Gender issues and concerns in development ,dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
VMG issues and	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and


concerns in development, dissemination, adoption and scaling up	<p>quality seeds) than men</p> <ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Brochures</p> <ul style="list-style-type: none"> • Cowpea growing brochures
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	<p>Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org</p>
Lead organizations and scientists	KALRO- AMRI Katumani, MoALF&I – County governments, Cowpea breeder- Rose Kuruma
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.9. KVU419

TIMP Name	KVU419 (Dual Purpose variety)
Category (i.e. technology, innovation or management practice)	<p>Technology -:</p> 


A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to unavailability and inaccessibility of high yielding commercial varieties
What is it? (TIMP description)	Variety KVV 419 is a dual purpose cowpea variety for both grain and vegetable use. It is an early maturing variety and can grow from sea level to 1600 m above sea level (asl). It has a grain yield potential of 800 – 1.1 t/ha. The seed is creamy brown in color.
Justification	Harvest of cowpea leaves as a vegetable as well as grain from the same plant (dual-purpose) is a primary goal for farmers, which allows them to exploit the nutritional benefits of both. The leaves are consumed in a variety of traditional dishes, or dried for use in the dry season while the grains are consumed for different cowpea based products. From its production, rural families derive food, animal feed and income through the sales of the grain and fresh leaves.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital platforms • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals)AIP
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations–for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination

	<ul style="list-style-type: none"> Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> Inadequate information of new varieties to stakeholders Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) Weak or non-existent proper market information systems (MIS) Inaccessibility and availability of seeds Weak or non-existent stakeholder innovation platforms Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Develop and disseminate information to the various stakeholders Adequate production of breeder seed and linking to KALRO seed unit and private seed companies for production of adequate seed for farmers Promote Proper marketing models that encourage collective production and marketing Improve on seed access through the agro-dealer system Establish and strengthen stakeholder innovation platforms and identify the platform leaders Involve county governments, Extension, marketers and processors Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> Creation of awareness on nutritive and economical importance of the variety. Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. Increase public and private dialogue to approve models that will ensure compliance with international standards Provision of improved market information system on volume, quality and supply consistency requirements Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Following good management of the crop and land, a yield of 324-445 kg/acre would give an income of KES.19,425 – 26,700/acre and estimated net returns of KES.7,375 – 14,659 per acre in one season.


Gender issues and concerns in development, dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO- AMRI Katumani, MoALF&I – County governments, Cowpea breeder- Rose Kuruma
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.10. Kenya Kunde

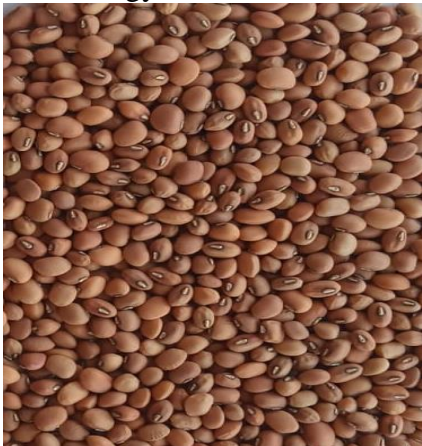
TIMP Name	Kenya Kunde (Kenya seed company- (Grain Type)
Category (i.e. technology, innovation management practice) or	Technology :- 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Lack of early maturing improved varieties for drought escape especially the marginal areas.
What is it? (TIMP description)	Kenya kunde is early maturing (80 -90 days) and it is grain type variety. It has yield potential of 0.8 -1.2 t/ha under good management. The pods are purple and are mostly borne above the canopy
Justification	Harvest of cowpea leaves for vegetable and grain from the same plant (dual-purpose) is a primary goal for farmers, which allows them to exploit the nutritional benefits of both. The leaves are consumed in a variety of traditional dishes, or dried for use in the dry season while the grains are consumed for different cowpea-based products. The dual purpose varieties will thus provide rural families with food, animal feed and income through the sales of the grain and fresh leaves.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies

Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital platforms • Partnerships (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIPs
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations–for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak a or non-existent proper market information systems (MIS) • In accessibility and availability of seeds


	<ul style="list-style-type: none"> • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and private seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Following good management of the crop and land, a yield of 324-486 kg/acre would give an income of KES.19,425 – 29,137/acre and estimated net returns of KES.7,375 – 17,087 per acre in one season.
Gender issues and concerns in development, dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men

	<ul style="list-style-type: none"> • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production, grain aggregation, value addition and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in grain aggregation, value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	Reference: Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO- AMRI Katumani, MoALF&I – County governments, Cowpea breeder- Rose Kuruma
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.11. Kunde – Mboga

TIMP Name	Kunde – Mboga (Kenya seed company- Vegetable type)
Category (i.e. technology, innovation management practice) or	Technology -: 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Food and nutrition insecurity in ASALs
What is it? (TIMP description)	Kunde Mboga is a dual purpose variety. It has tender leaves, very high returns on investmentS has soft dark green leaves, very long harvesting period The potential grain yield is 800- 1000 kg/ha and the leafy vegetable potential yield 4 – 6 t/acre
Justification	Food and nitrition insecurity is a threat to poor communities, particularly those living in the marginal areas. African Indigenous Vegetables (AIVs) contain vitamins and micronutrients not found in most exotic vegetables, and therefore their consumption could contribute to resolving malnutrition among poor rural households. The leaves are a good source of iron, Calcium, Phosphorous, Zinc, and Vitamin B. The leaves also are good source of protein. Higher consumption could lead to improved rural incomes through sales into urban niche markets, resulting in enhanced community development.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital platforms • Partnerhips (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIP
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors

	<ul style="list-style-type: none"> • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak a or non-existent proper market information systems (MIS) • In accessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and privates seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social,	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the

environmental, policy and market conditions necessary for development and up scaling	<p>variety.</p> <ul style="list-style-type: none"> • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	<p>Grain yield: Following good management of the crop and land, a yield of 324-405 kg/acre would give an income of KES. 19,425 – 24,280/acre and estimated net returns of KES. 7,375 – 12,231 per acre in one season.</p> <p>Returns from vegetables: A well managed crop yields on average 7,689kg/acre of vegetables, in about 3 harvests. This gives an income of KES.230,667, and an estimated net return of KES.218,617</p>
Gender issues and concerns in development, dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production and marketing
VMG issues and	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and


concerns in development, dissemination, adoption and scaling up	<p>quality seeds) than men</p> <ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	<p>Reference:</p> <p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p>
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	<p>Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org</p>
Lead organizations and scientists	KALRO- AMRI Katumani, MoALF&I – County governments, Cowpea breeder- Rose Kuruma
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.12. Usimpe Mtu Mdgo

TIMP Name	Usimpe Mtu Mdgo (Leafy vegetable varieties)
Category (i.e. technology, innovation management practice) or	<p>Technology</p> 


A: Description of the technology, innovation or management practice	
Problem to be addressed	Non- availability of high yielding cowpea leafy vegetable type varieties
What is it? (TIMP description)	It is a cowpea variety for use as a leafy vegetable. It has an indeterminate growth pater with a The stem can grow to a length of 126.9 cm and the leaves are glabrescent. The cumulative multiple harvest of fresh leaves is 20 tons/ha/season while single harvest fresh weight is 6.2 tons/ha
Justification	ALVs contain vitamins and micronutrients not found in most exotic vegetables, and therefore their consumption could contribute to resolving malnutrition among poor rural households. The leaves are good source of iron, Calcium, Phosphorous, Zinc, and Vitamin B. The leaves also are good source of protein. Higher consumption could lead to improved rural incomes through sales into urban niche markets, resulting in enhanced community development.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital platforms • Partnerhips (NGOs, CBOs, Churches, etc) • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIP
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations–for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets

	<p>and credit facilities</p> <ul style="list-style-type: none"> County governments and central governments (Formal and informal) for policy, create awareness and dissemination Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> Inadequate information of new varieties to stakeholders Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) Weak or non-existent proper market information systems (MIS) Inaccessibility and availability of seeds Weak or non-existent stakeholder innovation platforms Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Develop and disseminate information to the various stakeholders Adequate production of breeder seed and linking to KALRO seed unit and private seed companies for production of adequate seed for farmers Promote Proper marketing models that encourage collective production and marketing Improve on seed access through the agro-dealer system Establish and strengthen stakeholder innovation platforms and identify the platform leaders Involve county governments, Extension, marketers and processors Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> Creation of awareness on nutritive and economical importance of the variety. Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. Increase public and private dialogue to approve models that will ensure compliance with international standards Provision of improved market information system on volume, quality and supply consistency requirements Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Returns from vegetables: A well managed crop of <i>Usimpe mtu mdogo</i> variety yields on average 8,094kg/acre of vegetables, in about 3 harvests. This gives an


	income of KES.242,807, and an estimated net return of KES.230,757	
Gender issues and concerns in development ,dissemination, adoption and scaling up		<ul style="list-style-type: none">• Women perform most of the cowpeas production activities such as planting, weeding and harvesting• Cow peas are considered as women’s enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men• Women have less access to agricultural information, technology and knowledge on cowpeas production than men• The technology may not be adopted if the gender targeted especially women is overburdened• Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles• Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none">• Employment opportunities exist for youth in transporting the produce to the market• Opportunities exist for youth to produce and market cowpeas through application of ICT• Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing• Youths and women can be involved in cowpeas production and marketing	
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none">• VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men• VMGs have less access to agricultural information, technology and knowledge than men• 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	<ul style="list-style-type: none">• Opportunities exist for unemployed youth and those recovering in value addition and marketing• Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security	
E: Case studies/profiles of success stories		
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets	
Application guidelines for users	Kuruma, R.W., <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya	
F: Status of TIMP	Ready for upscaling	

readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Kuruma R.
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.12. Sura Mbaya

TIMP Name	Sura Mbaya (African Leafy vegetable variety)
Category (i.e. technology, innovation management practice) or	Technology 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Non- availability of high yielding cowpea leafy vegetable type varieties
What is it? (TIMP description)	This is a cowpea variety for use as a leafy vegetable. It has indeterminate growth pattern and the stem can. The canopy width length is 102 cm and the leaves are glabrescent. The cumulative multiple harvest of fresh leaves is 22.5 tons/ha while single harvest fresh weight is 7.9 tons/ha
Justification	ALVs contain vitamins and micronutrients not found in most exotic vegetables, and therefore their consumption could contribute to resolving malnutrition among poor rural households. The leaves are good source of iron, Calcium, Phosphorous, Zinc, and Vitamin B. The leaves also are good source of protein. Higher consumption could lead to improved rural incomes through sales into urban niche markets, resulting in enhanced community development.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field schools, • Field days • Agricultural shows • Digital platforms • Partnerships (NGOs, CBOs, Churches, etc)


	<ul style="list-style-type: none"> • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIP
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) • An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) • Positive interaction between Farmers & agro –Agro-Processors • Good Marketing Models and path ways • Strong linkage among cowpea value chain actors leading producers to market • County and central government support • Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Public, Private seed companies for production and distribution of seeds • Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations • KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak a or non-existent proper market information systems (MIS) • In accessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and privates seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production

	<p>and marketing</p> <ul style="list-style-type: none"> • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Returns from vegetables: A well managed crop of <i>Sura mbaya variety</i> yields on average 9,105kg/acre of vegetables, in about 3 harvests. This gives an income of KES.273,158, and an estimated net return of KES.261,108
Gender issues and concerns in development ,dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men <p>agricultural information, technology and knowledge on cowpeas production than men</p> <ul style="list-style-type: none"> • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men


Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	Kuruma, R.W., <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Kuruma R.
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.13. Katsetse

TIMP Name	Katsetse (African Leafy vegetable variety)
Category (i.e. technology, innovation or management practice)	Technology


		
A: Description of the technology, innovation or management practice		
Problem to be addressed	Non- availability of high yielding cowpea leafy vegetable type varieties	
What is it? (TIMP description)	The Variety is of leafy vegetable use. It's an indeterminate variety. The canopy width length is 102 cm and the leaves are glabrescent. The cumulative multiple harvest of fresh leaves is 22.5 tons/ha while single harvest fresh weight is 7.9 tons/ha	
Justification	ALVs contain vitamins and micronutrients not found in most exotic vegetables, and therefore their consumption could contribute to resolving malnutrition among poor rural households. The leaves are good source of iron, Calcium, Phosphorous, Zinc, and Vitamin B. The leaves also are good source of protein. Higher consumption could lead to improved rural incomes through sales into urban niche markets, resulting in enhanced community development.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	<ul style="list-style-type: none">• Farmers, Traders (retailers, wholesalers, etc), National, Regional and International markets, Agro-processing companies	
Approaches used in dissemination	<ul style="list-style-type: none">• On farm demonstrations,• Farmer field schools,• Field days• Agricultural shows• Mobile applications (facebook, twitter, etc)• Partnerhips (NGOs, CBOs, Churches, etc)• Farmer research networks• Farmer to farmer extension• Mass media – Agricultural programs• Promotional materials (posters/brochures/leaflets, manuals)• AIP	
Critical/essential factors for successful promotion	<ul style="list-style-type: none">• Good seed system to improve seed availability and accessibility (production of early generation seed (EGS))• An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers)• Positive interaction between Farmers & agro –Agro-Processors• Good Marketing Models and path ways• Strong linkage among cowpea value chain actors leading producers to market• County and central government support• Funding to research, validate and promote new cowpea varieties	
Partners/stakeholders	<ul style="list-style-type: none">• Public, Private seed companies for production and distribution of seeds	

for scaling up and their roles	<p>Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling</p> <ul style="list-style-type: none"> • Local traders and exporters – for provisions of input and uptake of outputs marketing • Market/ agro-processors (value addition) actors to create a demand and pull production • NGOs: technology dissemination through on-farm demonstrations KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities • County governments and central governments (Formal and informal) for policy, create awareness and dissemination • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate information of new varieties to stakeholders • Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) • Weak a or non-existent proper market information systems (MIS) • In accessibility and availability of seeds • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and privates seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and


	<p>supply consistency requirements</p> <ul style="list-style-type: none"> • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Returns from vegetables: A well managed crop of <i>Katsetse</i> yields on average 9,105kg/acre of vegetables, in about 3 harvests. This gives an income of KES.273,158, and an estimated net return of KES.261,108
Gender issues and concerns in development, dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security

E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	Kuruma, R.W., <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Cowpea breeder- Rose Kuruma
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.1.15. Mnyenze Madamada

TIMP Name	Mnyenze Madamada (African Leafy vegetable variety)
Category (i.e. technology, innovation or management practice)	Technology 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Non- availability of high yielding cowpea leafy vegetable type varieties
What is it? (TIMP description)	The Variety is of leafy vegetable use. It's an indeterminate variety. The canopy width length is 114 cm and the leaves are glabrescent. The cumulative multiple harvest of fresh leaves is 19.5 tons/ha while single harvest fresh weight is 8 tons/ha
Justification	ALVs contain vitamins and micronutrients not found in most exotic vegetables, and therefore their consumption could contribute to resolving malnutrition among poor rural households. The leaves are good source of iron, Calcium, Phosphorous, Zinc, and Vitamin B. The leaves also are good source of protein. Higher consumption could lead to improved rural incomes through sales into urban niche markets, resulting in enhanced community development.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> Farmers, Traders (retailers, wholesalers, etc), National, Regional and

	International markets, Agro-processing companies
Approaches used in dissemination	<ul style="list-style-type: none"> On farm demonstrations, Farmer field schools, Field days Agricultural shows Mobile applications (facebook, twitter, etc) Partnerships (NGOs, CBOs, Churches, etc) Farmer research networks Farmer to farmer extension Mass media – Agricultural programs Promotional materials (posters/brochures/leaflets, manuals) Web material's
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Good seed system to improve seed availability and accessibility (production of early generation seed (EGS)) An enabling market environment for farmers to sell their cowpea products (increasing bargaining power of farmers) Positive interaction between Farmers & agro –Agro-Processors Good Marketing Models and path ways Strong linkage among cowpea value chain actors leading producers to market County and central government support Funding to research, validate and promote new cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> Public, Private seed companies for production and distribution of seeds Decentralized Informal Farmer-based Seed System (DIFBSS) organizations—for low cost seed production and up-scaling Local traders and exporters – for provisions of input and uptake of outputs marketing Market/ agro-processors (value addition) actors to create a demand and pull production NGOs: technology dissemination through on-farm demonstrations KILIMO trust capacity building of farmers and linking farmers to markets and credit facilities County governments and central governments (Formal and informal) for policy, create awareness and dissemination Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> Inadequate information of new varieties to stakeholders Weak seed systems (seed companies promote more of hybrid compared to self-pollinated crops) Weak a or non-existent proper market information systems (MIS) In accessibility and availability of seeds

	<ul style="list-style-type: none"> • Weak or non-existent stakeholder innovation platforms • Limited processing technologies and consumption diversity at the household level
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Develop and disseminate information to the various stakeholders • Adequate production of breeder seed and linking to KALRO seed unit and private seed companies for production of adequate seed for farmers • Promote Proper marketing models that encourage collective production and marketing • Improve on seed access through the agro-dealer system • Establish and strengthen stakeholder innovation platforms and identify the platform leaders • Involve county governments, Extension, marketers and processors • Use partners innovations to promote value addition and consumption in local food systems
Lessons learned in up scaling if any	Creation of market opportunities could lead to enhanced adoption of technology
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on nutritive and economical importance of the variety. • Harmonious gender consideration in research, consumption and marketing as it is mainly cultivated by women hence the need to build their capacity. • Increase public and private dialogue to approve models that will ensure compliance with international standards • Provision of improved market information system on volume, quality and supply consistency requirements • Enabling policy for provisions of markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, a seed rate of 8kg/acre is achieved, at a cost of approximately KES.1,600/per acre, which is 13% of the total variable costs of KES.12,050/acre
Estimated returns	Returns from vegetables: A well managed crop of <i>Mnyenze madamada</i> variety yields on average 7,891kg/acre of vegetables, in about 3 harvests. This gives an income of KES.236,737, and an estimated net return of KES.224,687
Gender issues and concerns in development, dissemination, adoption and scaling up	 <ul style="list-style-type: none"> • Women perform most of the cowpeas production activities such as planting, weeding and harvesting • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, quality seed and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men

	<ul style="list-style-type: none"> • The technology may not be adopted if the gender targeted especially women is overburdened • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Youths and women can be involved in cowpeas production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Consumption – people are becoming increasingly conscious on healthy diets. Leaves sold in peri-urban markets, supermarkets
Application guidelines for users	Kuruma, R.W., <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for upscaling
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Kuruma R.
Partner organizations	AGRA, USAID, KEPHIS, Farmers

2.2. COWPEA SEED SYSTEMS

2.2.1. Informal (Farmer saved) seed systems

TIMP Name	Informal (Farmer saved) seed systems
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Ninety to Nity five of cowpea seed is sourced by farmers through informal means. The source of seed is usually from the traditional farm saved seed which in most cases has admixtures resulting to genetic deterioration and low yields. In addition, under traditional farmer-saved-seed-system, selection of seed is done after harvesting and is based on external characteristics such as size and colour and does not consider such parameters as germination, purity and moisture content. This results to decrease of yields in every subsequent growing season and loss of quality and originality of the variety.
What is it? (TIMP description)	In order to achieve the yield potential in production of cowpea, certified seed improved varieties should be acquired. The sources for cowpea seed include Public entities like KALRO Seed Unit, and Private seed companies such as Kenya seed company, Dry land seed company, East Africa Seed Company etc. However, most farmers are resource poor and can be enabled to cut the cost of acquiring certified seeds through capacity building on how to select their own seeds with proper guidance from extension providers. This option is unfortunately short-term and can only be done for three seasons after which a farmer is advised to source certified seed to avoid reduced yield due to lowered quality of the variety.
Justification	Availability of quality seed is essential for cowpea farmer to attain the potential yields. Farmers should be empowered and be able to identify seed sources, have skills to identify genuine seed and be able to select and preserve own quality seed. The cultivation of traditional varieties using farm saved seed produced under improved farmer-saved-seed system will contribute to increased yields, maintain genetic purity and conserve biodiversity of farmer preferred traditional cowpea varieties with good attributes such as pest and disease resistance, palatability and adaptability. The traditional farmer accessions can make a good gene pool for various specific unique traits of interest and make significant contributions during the research processes.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed dealers, Researchers, Extension
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field and business schools, • Field days • Agricultural shows • Mobile applications, • Partnerhips • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals)

	<ul style="list-style-type: none"> • Web material's
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good seed systems • Affordability of certified seed • Good extension support • Funding
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to develop, validate and promote improved climate smart cowpea varieties where quality seed can be availed through improved farmer-saved-seed-system • KALRO in collaboration with County MoALFC extension officers to validate and document improved farmer-saved-seed-system. • KALRO Seed Unit to provide certified seed for selected cowpea lines • Farmers/farmer groups to adopt improved farmer-saved-seed-system to produce seed and probably sell to other farmers.
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni, Tharaka Nithi, Machakos, Kilifi, Kwale (Mainly in cowpea growing areas)
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Improved farmer-saved-seed-system is not well documented and Agricultural extension officers • Lack of knowledge and skills to disseminate improved farmer-saved-seed-system. • Unwillingness of farmers to embrace improved farmer-saved-seed-system. • Farmers with small farms of cowpea unable to maintain purity. • Low awareness of importance of quality cowpea seed in most parts of Kenya
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Validate and document improved farmer-saved-seed-system. • Develop manuals for training. • Organize farmer groups/CIGs/VMGs at community level for ease of training and follow up. • Identify and train public and private agricultural extension officers • Lead farmers to be trained on improved farmer-saved-seed-system for ease of dissemination/ Train on own dry cowpea seed selection and preservation
Lessons learned in up scaling if any	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 up scaling	<ul style="list-style-type: none"> • Establish innovation plat forms that involves farmers, national and county governments and NGOs to promote used of quality cowpea seed. • Creation of awareness on importance of practicing improved farmer-saved-seed-system instead of using traditional farmer-saved-seed-system. • Registration of CIGs/VMGs will ease in dissemination and follow up. • Harmonious gender and social consideration in research, consumption and marketing. . • Policy on community seed production should be put in place to guide in enabling farmers produce dry bean seed


D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, and a seed rate of between 6-8kg/acre depending on the grain size, the cost of informal seed system is KES. 1,200 – 1,600 per acre in the first year. This cost comprises 10-13% of the total variable costs of KES.12,050/acre
Estimated returns	As long good agronomic management are embraced, the farmer can get net returns of between KES. 7,375 and KES. 41,000 depending on the variety grown, and if certified seed is purchased in the first season. The yields for the subsequent seasons will, however, decline as seed is recycled in the informal seed system.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to quality seed than men • Cow peas are considered as women's enterprise yet women have limited access and control of agricultural resources such as land, implements, credit, and labour than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market cowpeas through application of ICT • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Opportunities exist for women employment in cowpeas production and value addition
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering in value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> • No documentation
Application guidelines for users	
F: Status of TIMP readiness (1-ready for upscaling; 2-	Requires research and validation

requires validation; 3-requires further research)	
G. Contacts	
Contacts	Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org
Lead organizations and scientists	KALRO- AMRI Katumani, MoALF&I – County governments, Cowpea breeder- Rose Kuruma
Partner organizations	CARITAS, Farm concern

Research gaps

- Research, testing and validation of farmer-saved-seed needs to be done
- Identification of local and improved varieties to be subjected to own seed selection

2.2.2 Formal Seed Systems

TIMP Name	Formal Seed Systems
Category (i.e. technology, innovation or management practice)	<p>Innovation</p>  <p>Commercial Seed inspection by KEPHIS team</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Lack of accessibility of improved cowpea varieties and poor accessibility to quality seeds by the smallholder farmers
What is it? (TIMP description)	It is a highly regulated seed production and supply system that avails certified seed varieties while ensuring that varietal identity and purity are maintained throughout the seed production process. The seed production stages are subject to official quality seed assurance as prescribed national seed standards and approved by the certification agency, Kenya plant health inspectorate services (KEPHIS).
Justification	The KALRO has released many improved climate smart cowpea 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 these improved varieties. Supporting KALRO

	Seed Unit to produce the EGS ensures that there is availability and timely production of the certified seed which will result in increased productivity and production of cowpea in Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed dealers, Researchers, Extension
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations, • Farmer field and business schools, • Field days • Agricultural shows • Mobile applications, • Partnerhips • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • AIP
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Innovation platform for interaction of cowpea seed value chain stakeholders. • A strong public – private cowpea 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 path ways. • Public and private agricultural service providers. • Funding for production of early generation seed and certified seed for promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO Seed Unit for production of early generation seed. • KALRO legal office to license more 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 to take up cowpea e.g. Africa Harvest, Farm Africa for farmer organizing and mobilization. • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui and Makueni, Tharaka Nithi, Machakos, Kilifi, Kwale (Mainly in cowpea growing areas)
Counties where TIMP will be up scaled	Turkana

Challenges in dissemination	<ul style="list-style-type: none"> • Lack of innovation platforms to facilitate interaction among cowpea seed value chain stakeholders. • Unwillingness of seed companies to take up KALRO varieties. • Delayed MoU between KALRO and seed companies. • Unwillingness of farmers to buy certified seed. • Low awareness of importance of improved cowpea in some parts of Kenya •
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish innovation platforms for cowpea seed value chain stakeholders. • Establish demonstration to showcase new improved varieties for seed companies to select from. Strengthen public – private cowpea seed value chain. • License seed companies and merchants to produce certified seed of released varieties by KALRO. • Strengthen KALRO Seed Unit to produce early generation seed. • Ensure certified seed affordability, availability and accessibility for commercial production. Well organized farmer cowpea seed producer groups and networks. • County and central government support. • Develop good policies for the cowpea seed production and marketing. Funding for research, validation and promotion of new cowpea varieties and seed production
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Creation of awareness through demonstrations helps seed companies identify and pick best climate smart cowpea varieties for production of certified seed. • Availability of markets
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • A strong innovation platform for cowpea seed value chain stakeholders • MOU between KALRO and willing seed companies/merchants for production of certified seeds. • Harmonious gender and social consideration in cowpea seed production and marketing. Farmer producer organizations for cowpea seed production
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Using recommended spacing, and a seed rate of between 6-8kg/acre depending on the grain size, the cost of formal seed system is KES. 1,200 – 1,600 per acre per season. This cost comprises between 10-13% of the total variable costs of KES.12,050/acre
Estimated returns	As long good agronomic management are embraced, the farmer can get net returns of between KES. 7,375 and KES. 41,000 per acre in a season from consistent use of certified seed.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to land for contractual quality seed production than men • Women have less access to agricultural information, technology and knowledge on cowpeas production than men • Women have limited access to regional or national markets as they sometimes cannot travel to far due to their domestic roles • Women have less access to credit required for quality seed production than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in transporting the produce to the market • Opportunities exist for youth to produce and market quality cowpeas seed

	<p>through application of ICT</p> <ul style="list-style-type: none"> • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Opportunities exist for women employment in cowpeas production and value addition
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • 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	<ul style="list-style-type: none"> • Employment opportunities exist for unemployed youth and those recovering in value addition and marketing • Increased production will lead to increased consumption of cowpeas by the VMGs hence improving their food and nutritional security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> • No documentation
Application guidelines for users	Kuruma, R.W., <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Requires research and validation
G. Contacts	
Contacts	<p>Institute Director KALRO – AMRI Katumani P.O. Box 340 Machakos Email: director.amri@kalro.org</p>
Lead organizations and scientists	KALRO- AMRI Katumani, MoALF&I – County governments, Cowpea breeder- Rose Kuruma
Partner organizations	CARITAS, Farm concern

Research Gaps

- Unavailability of early generation seed of KALRO released climate smart cowpea varieties.
- Inadequate promotion and up-scaling of the released varieties

2.3 GOOD AGRICULTURAL PRACTICES (GAP) AND FOOD SAFETY MANAGEMENT SYSTEMS

2.3.1 Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for cowpea value chain in Kenya

TIMP Name	Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for Cowpea 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	Risk of occurrence of health threatening chemical hazard occurrence due to heavy metal accumulations like lead/mercury/cadmium and MRLs above permitted levels from pesticides
What is it? (TIMP description)	This HACCP system is designed to minimize the risk of food safety hazards by identifying the hazards, establishing controls and monitoring these controls. When this HACCP concept is applied to the management of likely adverse health effects resulting from exposure to hazards in the cowpea value chain a wholesome and safe Cowpea value chain can be maintained improving on trade and health within and without Kenya borders.
Justification	<p>The HACCP approach can be applied to all stages of the cowpea value chain process, ranging from production to processing, transportation, retail in commercial establishments and/or direct utilization by the consumer. Through its application, food safety charts in the cowpea value chain will easily be identified through critical control points. This will set limitation values for monitoring so that action can be taken if the set point values of hazards are out of the defined range required.</p> <p>In this cowpea value chain, if the proposed FSMS be adopted, different hazards would be minimized in every phase of production, harvesting, processing, distribution and consumption making cowpea grain safe for consumption by Kenyans.</p> <p>Key elements will be identified that will be used or modified to reduce hazards formation in all steps of production to consumption.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, food vendors and consumers.
Approaches used in dissemination	<ul style="list-style-type: none"> • Common Interest Groups discussions • Field days • Exhibitions, • Electronic media (radio, TV) • Social media (Whats App, Facebook, Twitter). • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Use of expert team composed of HACCP specialist, food scientist, microbiologist, representative of the Cowpeanut growers, public

	<p>health officer, and a quality control and safety specialist from the Kenya Bureau of Standards will be formulated.</p> <ul style="list-style-type: none"> • Distribution of the printed HACCP plan to cowpea value chain actors for implementation in order to reduce hazards. • Applied and adaptive Research to test, validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • KEBS and PCPB for legislating in food safety, regulations and sale of pesticides • Producers and exporters associations to mobilise producers for training • Agricultural County extension staff for dissemination • Universities (Public and Private) and Private sector to collaborate in training
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Inadequate funds to reach value chain actors • Lack of platform for interaction with cowpea value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Funding of dissemination platforms • Establish cowpea innovation platforms
Lessons learnt in upscaling, if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	The policies and laws in public health in place in Kenya are supportive to the use of HACCP Plan in cowpea value chain.
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	<ul style="list-style-type: none"> • Women and youth have limited access to land for cowpea cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as quality cuttings than men. • Women and youth may have less access to credit than men • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Proper application of HACCP will lead to improved health of the various gender categories such as women • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production and marketing • Opportunities for youths and women exists in cowpea production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • 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

	<ul style="list-style-type: none"> • VMGs may have less access to markets • VMGs have limited access to land for cowpeas cultivation than men • VMGs may have less access to credit • VMGs have less access to agricultural information, technology and knowledge than men • High illiteracy level of the VMGs makes them unable to read the dissemination documents and other materials
VMG related opportunities	<ul style="list-style-type: none"> • Affirmative action in the provision of finances to VMGs • Opportunities exist for youth in the transportation hub of quality cowpeas grain • Increased production will lead to increased consumption and utilization of cowpeas hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<ul style="list-style-type: none"> • KALRO KCSAP Biological Hazards factsheet • KALRO KCSAP Food Safety Culture factsheet • KALRO KCSAP Chemical Hazards factsheet • KALRO KCSAP Hazard Analysis Critical Control Point (HACCP) factsheet
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling;
G: Contacts	
Contacts	KALRO PTC P O Box 6223 01000 Email: info.ptc@kalro.org
Lead organization/scientists	KALRO: Athony Nyaga, John N. Ndung'u, James Ndambuki, Dr. Francis Wayua, Dr. Lusike Wasilwa, Violet Kirigua,
Partner organizations	MoALFC, AFA, FPEAK, PCPB, AAK, KEPHIS, County governments, NGOs, Universities

2.3.2 Good Agricultural Practices (GAP) for Cowpea

TIMPs name	Good Agricultural Practices (GAP) for Cowpea
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, Unsustainable farming practices, adverse environmental impact, Worker safety and health and Traceability
What is it? (TIMP description)	<p>This is a set of agricultural practices that when implemented ensures four 'pillars' of GAP (economic viability, environmental sustainability, social acceptability and food safety and quality) are met. It is a systematic process of implementing a standardized production system globally designed to reassure consumers about how food is produced on the farm, pre-farm gate or on-farm standards.</p> <p>It is not about a specific crop production but the process through which production takes.</p>


Justification	GAP is of utmost importance in protecting consumer health. It ensures safety throughout the food chain. It must be compulsory, transparent and operate not only from the table but also upstream to include suppliers (e.g. fertilizers, plant protection) and all value chain players including providers of logistics and farm equipment
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	All Cowpea value chain players including producers, extension staff, processors, transporters and market outlet operators including wholesale and retail chains, domestic markets and farm gate handlers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • FFBS, • On-farm experimentation and dissemination • Field days, shows • Farmer to farmer communication • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Policy support from government • Applied and adaptive Research to test, validate and release improved Cowpea varieties • A platform for interaction of Cowpea value chain stakeholders
Partners/stakeholders for scaling up and their roles	Producer organizations, NGOs, MoALFC, Private extension providers, CoG and other value chain players
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Lack/inadequate knowledge on the benefits GAP • Lack of legislative mechanisms to support the GAP, in particular the domestic scope • The perception that GAP is oppressive rather than supportive • Applied and adaptive Research to test, validate and release improved Cowpea varieties • A platform for interaction of cowpea value chain stakeholders
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Continuous training of farmers, extension staff and other value chain players • Establish cowpea innovation platforms
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary	Supportive policy of national and county governments to promote adaption of GAP.
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,	<ul style="list-style-type: none"> • Most small-scale production systems are centered on women and hence it's them who suffer from the detriments of poor processes; for example, improper application of pesticides results in more women suffering from complications than men in small scale holdings. This

	<p>means that adaption of GAP will increase the benefits of good health to the women and those who work more on the farm</p> <ul style="list-style-type: none"> • Women and youth have limited access to land for cowpea cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as seeds than men. • 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 • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Proper application of GAP will lead to improved health of the various gender categories such as women • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea and marketing • Opportunities for youths and women exists in cowpea production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • 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 less access to agricultural information, technology and knowledge than men • High illiteracy level of the VMGs makes them unable to read the dissemination documents and other materials
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths and those recovering from drugs exists in Cowpea production and marketing • Increased production will lead to increased consumption and utilization of Cowpea hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	<ul style="list-style-type: none"> • Options for certification exist depending on whether it is a single holder certification or group compliance. • Compliance is a process and hence takes time and involves a process of continuous improvement. • No need for farm sophistication to adopt. • There is provision for taking corrective action for all noncompliance at time of assessment. • Requires continuous training and exposure to better systems
F: Status of TIMP readiness (1. Ready for upselling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	KALRO PTC
Lead organization/scientists	KALRO: Athony Nyaga, John N. Ndung'u, James Ndambuki, Dr.

	Francis Wayua, Dr. Lusike Wasilwa, Violet Kirigua,
Partner organizations and their roles	MoALFC, AFA, FPEAK, PCPB, AAK, KEPHIS, County governments, NGOs, Universities

2.4 AGRONOMIC MANAGEMENT PRACTICES


2.4.1. Land preparation

TIMP Name	Land preparation 
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low crop yield due to poor seedbed
What is it? (TIMP description)	This is the process of making the land ready for planting by breaking and turning the soils to a desired form and tilth in order to make a seedbed suitable for a specific crop. It involves breaking up soil clods by hand hoe or tractor/animal drawn implements.
Justification	Good land preparation enhances weed control, aeration and mixing of organic matter with the soil. Adequate land preparation coupled with mound/ridge preparation also ensure increased water infiltration prevent competition from weeds that would otherwise result in significant yield losses thus multiple plowing prior to planting is also weed control measures. Also, the better soil aeration permitted by mounds/ridges and less tendency for soil compaction due to adequate preparation result in higher yields being recorded.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer extension • Seminars, Meetings, trainings
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Awareness on crop yield losses associated with poor land preparation • Sensitization on benefits of quality land preparation • Provision of subsidy to equipment operators involved in land

	preparation.
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • County Governments to facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western , Nyanza, Central Rift and Lower Eastern Counties
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • High cost of machinery services • Low access to appropriate machinery and equipment. • Cultural barrier to technology use
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Subsidies to tractor service provider • Establishment of agricultural machinery service units • Sensitization on need for quality land preparation
Lessons learnt in upscaling, if any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Provision of subsidized tractor services • Policy on lowering of import cost of farm equipments
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The main input cost is the labour for <i>land</i> preparation. The cost will depend on the land size, labor costs and the landscape terrain/slope /soil type/tractor driven plough. Basic cost ranges from KES 3000 to 4,000 per acre for motorized tractor. This comprises approximately 28% of total variable costs of KES. 14,550 under tractor-drawn. • Animal drawn plough charges are KES 1500 per acre, which is approximately 12% of the total variable costs of KES.12,050
Estimated returns	<ul style="list-style-type: none"> • Good and timely land preparation coupled with other management practices contributes towards increased yield of between KES. 5,625 and KES. 41,000 depending on the variety of certified seed grown, and whether animal or tractor drawn implement was used.
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women and youth have limited access to resources for quality land preparation than men • Women and youth have less access to farm implements such as pangas, jembes and tractors • Women and youth may have less access to credit than men • Women and youth are minimally involved in land preparation undertakings

	<ul style="list-style-type: none"> • The technology may not be adopted if the gender targeted especially women is overburdened or left out • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youths exists in providing land preparation services • High productivity realized with quality land preparation likely to benefit women and youth as relates to food security and realized incomes from produce sale • Young people will benefit in transporting increased farm produce to potential markets
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for cowpea cultivation than abled men • VMGs may also have limited access to finances to buy the required equipments for quality land preparation • VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • Women and other VMGs likely to benefit from increased productivity arising from quality land preparation • Increased production will lead to increased consumption and utilization of cowpea and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<ul style="list-style-type: none"> • Agricultural Machinery Services (AMS)Units • Fliers on quality land preparation from MoALFC, • Cowpea production manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	<ul style="list-style-type: none"> • Ready for upscaling.
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO-Katumani - R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi
Partner organizations	MoALFC-AMS, Universities

2.4.4 Crop Spacing

TIMP Name	Crop Spacing 
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low crop yields due to inappropriate plant density.
What is it? (TIMP description)	It is a management practice designed to place seeds at predetermined distance from each other. This may involve the distance from one plant mound to another and from one ridge to another ridge, and within the ridge. It is aimed at attaining optimum plant population per given area. For cowpea the recommended number is 27,000 per acre. This means about 16 kg of seed per ha
Justification	Improper spacing management practices have contributed to low yields due to low crop density. Also, challenges of field pests and diseases are greatly reduced as result of too bushy crop due to over-population. Or, the crop is too sparse that weeds become a menace.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • Farmer to farmer extension
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing awareness on negative effects of low or high plant density on crop yield • Efficient extension service
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups for increased visibility • VMGs will likewise benefit from the grants as they adopt the technologies and enhance awareness on the technology
C: Current situation and future scaling up	

Counties where already promoted. if any	Counties in lower and upper eastern Kenya
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Changing the producer mindset • Lack of awareness of simple techniques of achieving required plant density
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass grass root level, FFBS • Devising simple approaches to achieve required spacing and seed rate
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Producers find it laborious to use marked string for proper spacing in seed placement
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Opportunities for increased yields due to reduced nutrient competition or underexploitation of same resources with lower plant density • Change in farmer mindset that high density of plants has no effect on anticipated crop yield
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The main input cost for crop spacing is the labour during planting, which could also be mechanized through use of tractor seeder or animal drawn. The average cost of crop spacing is KES.1,500 per acre, comprising 12% of total variable costs of KES.12,050
Estimated returns	<ul style="list-style-type: none"> • Using the recommended crop spacing coupled with other management practices contributes towards increased yield of between KES.5,625 and KES.41,000 depending on the variety of certified seed grown, and whether animal or tractor drawn implement was used in the initial operations
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth are the ones who mostly perform the task of planting • Women and youth may also have limited access to finances to buy the required inputs such as quality seed than men. • Women and youth may also have limited access to farm implements required to perform the operation • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth likely to be beneficiaries of high crop yields that ensures food and nutritional security • Youth likely to benefit in charging fee for transporting extra produce to potential markets
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for cowpea cultivation than men • VMGs may also have limited access to finances to buy the required implements for proper planting • VMGs have less access to agricultural information, technology and

	knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> Increased food and nutritional security for VMGs in as high crop yields are realized Increased production will lead to increased incomes of VMGs involved in cowpea value chain
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> Increased return to investment with appropriate crop population in Kenya
Application guidelines for users	<ul style="list-style-type: none"> Cowpea production manual Modules and Manuals on cowpea spacing
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	<ul style="list-style-type: none"> Ready for upscaling
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO, R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi
Partner organizations	MoALFC, Universities, ICRISAT

2.4.5 Fertilizer/manure application

TIMP Name	Fertilizer/Manure application
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 infertile soils
What is it? (TIMP description)	It is the addition of predetermined amounts of fertiliser or manures to return nutrients lost due to crop harvest or to correct nutritional deficiencies.
Justification	Continuous cultivation depletes soil organic matter and depletes essential plant nutrients resulting in low crop yields. In order to sustain high crop yields, either organic or inorganic plant nutrient or both have to be applied on continuous basis to replace nutrients with harvested crop or to correct nutritional deficiencies. However, legumes like cowpea require small external fertilizer N inputs because they are nitrogen fixers
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> On-farm demonstration Field days Agricultural shows MoALFC/Extension officers Farmer to farmer extension
Critical/essential factors for	<ul style="list-style-type: none"> Increasing productivity per unit

successful promotion	<ul style="list-style-type: none"> • Affordable fertilizer
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies and could enhance awareness on technologies and innovations.
C: Current situation and future scaling up	
Counties where already promoted, if any	Central, Eastern, Western, Upper and lower Rift Valley
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Mindset that fertilizers not good for some soils • Unavailability of manure • High labour requirement in manure application • High cost of inorganic fertilizers
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmer sensitization and on farm demos • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level ie FFS • Developing simple equipment for manure application • Enhanced subsidies on organic and inorganic fertilizer inputs
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • High cost of organic and inorganic fertilizer inputs hinder adoption of the technology • Inadequate knowledge on proper handling and application of inputs hinder adoption
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Availability of information on recommended fertilizer type for different zones • Change of mindset on fertilizer use • Well-coordinated fertilizer input subsidies • Opportunities for increased yields due to improved nutrient availability to the plants
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 4700 per acre for fertilizer • KES 4800 per acre for manure
Estimated returns	<ul style="list-style-type: none"> • KES 12,000 per acre for fertilizer • KES 8,000 per acre for manure
Gender issues and concerns	<ul style="list-style-type: none"> • Women and youth have limited access to land for cowpea cultivation

in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> than men Women and youth may also have limited access to finances to buy the required fertilizer inputs than men. Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> Employment opportunities for youths exists in transportation of both the inputs and produce Opportunities for youths and women exists in provision of paid labour services in fertilizer input application
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to land for crop production than men VMGs may also have limited access to finances to buy the required inputs such as quality fertilizer inputs than men VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> Opportunities exist in the recent policy shift efforts to economically empower VMGs and bring them at par with the rest of the society through the youth and women enterprise funds Opportunities exist for women and other VMGs as beneficiaries of fertilizer input demonstrations Youth and other VMGs may benefit by providing labour required during fertilizer/manure application in the cowpea farms
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> The positive impact of fertilizer inputs on crop yields reported in low, medium and high potential areas
Application guidelines for users	<ul style="list-style-type: none"> Cowpea production guidelines Journal papers- East African Journal (Agroforestry and Agriculture Conference Proceedings- Dryland Farming Systems
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	<ul style="list-style-type: none"> Ready for upscaling
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO-Katumani - R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Nguluu
Partner organizations	MoALFC, Universities, ICRISAT

2.4.6 Crop rotation


TIMP Name	Crop rotation
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Extensive nutrient mining through monoculture, pest and disease build up
What is it? (TIMP description)	Crop rotation is the technique of planting different crops in the same field at alternately. A basic principle of crop rotation is to avoid growing the same crop for consecutive years, leguminous with non-leguminous, avoidance of crop of same family following one another in

	order to avoid build up pest and diseases.
Justification	Different types of plants require different types of nutrients from the soil and monoculture could result in depletion of a nutrient and decline in crop yield. Changing crops routinely allows the land to remain fertile, since not all of the same nutrients are being used each season. For example, planting a legume, such as soybeans, helps to replenish necessary nitrogen in the soil. Crop rotation can help to manage soil fertility, reduce soil erosion, improve soil health and increase nutrients availability to plants. Crop rotation also helps to reduce the build - up of diseases, such as viruses, and pests such as weevils and nematodes and, weed populations in cowpea
Region promoted	<ul style="list-style-type: none"> • Low, medium and high potential areas in Kenya
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Producers (farmers) • Extension agencies
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer extension
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Farmer sensitization • Use of long term demonstration farms • Farmers tour for knowledge acquisition from other successful farmers
Partners/stakeholders for scaling up	<ul style="list-style-type: none"> • NGOs • Extension • Private service providers • Research Organization and Universities
C: Current situation and future scaling up	
Counties where already promoted, if any	<ul style="list-style-type: none"> • Low, medium and high potential areas in Kenya
Counties where TIMPs can be up-scaled	<ul style="list-style-type: none"> • Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low publicity • Limited support from the county government and national government • Inadequate technology and research inputs
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Enhanced publicity • Enhanced support from national and county government
Lessons learnt in upscaling	<ul style="list-style-type: none"> • Availability of Cost benefit information that can attract farmers to engage in practicing appropriate crop rotations.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • There will be change of mindset-crop rotation not essential in crop production • The environment will be suitable for cowpea production • Cowpea derived products socially acceptable to the target community

	<ul style="list-style-type: none"> • Mechanisms to offload extra produce to local and distant markets in place
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Unknown
Estimated returns	<ul style="list-style-type: none"> • Its yet to be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land, quality cowpea and credit • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Women and youth have limited access and control on fertilizer inputs
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in performing the farm operation • Opportunities for youths exist in transporting the farm produce • Women and youth beneficiaries of high crop yields ensuring food and nutritional security
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seed cowpea seed • 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
VMG related opportunities	<ul style="list-style-type: none"> • Crop rotation places emphasis on the importance of using available land space to grow diverse food crops, increase biodiversity, manage pests thus the practice is economically viable for VMGs. • Opportunities exist for youth in providing paid farm labour and transporting the produce to local and distant markets
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • Unkwown
Application guidelines for users	<ul style="list-style-type: none"> • Cowpea production guidelines Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya •
F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	
	<ul style="list-style-type: none"> • Ready for upscaling
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO-Katumani - R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Nguluu
Partner organizations	MoALFC, Universities, ICRISAT

2.4.7 Intercropping

TIMP Name	Intercropping
Category (i.e. technology, innovation or management practice)	Management practice

	
A: Description of the technology, innovation or management practice	
Problem addressed	Declining soil fertility associated with monoculture. Limited diversity in rural household diets which negatively impacts on health of young and elderly
What is it? (TIMP description)	Intercropping refers to the growing of two or more crops on the same land at the same time.
Justification	Intercropping, in addition to improving crop and food diversity, can also: improve labour efficiency; increase soil fertility if nitrogen fixing intercrops are used; and reduce weed growth as it smothers the weeds. Cowpea fits well in most of the cropping systems: it can be done as relay crop just before harvesting of cereals.
Region promoted	<ul style="list-style-type: none"> • Low, medium and high potential areas
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Producers (farmers) • Extension agencies
Approaches used in dissemination	<ul style="list-style-type: none"> • Use of service providers, Tot, demonstrations, farmers tour
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Farmers tour for knowledge from other successful farmers
Partners/stakeholders for scaling up	<ul style="list-style-type: none"> • NGOs, extension, private service providers
C: Current situation and future scaling up	
Counties where already promoted, if any	<ul style="list-style-type: none"> • Low, medium and high potential areas
Counties where TIMPs can be up-scaled	<ul style="list-style-type: none"> • Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low publicity • Limited support from the county government and national government • Inadequate technology and research inputs

Suggestions for addressing the challenges	<ul style="list-style-type: none"> Enhanced publicity of the intercropping practice Enhanced financial and technical support for practice from national and county government
Lessons learnt in upscaling	<ul style="list-style-type: none"> Availability of Cost benefit information that can attract farmers to engage into the activities.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> There will be change in mindset that intercropping is not a viable agronomic practice Well-structured market channels for offloading extra produce
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> KEs. 2000 per acre
Estimated returns	<ul style="list-style-type: none"> To be established through further research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women have less access to land for cowpea cultivation than men Women and youths have less access to funds required for farm operations Women have less access to agricultural information, technology and knowledge than men Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles Women have less access to credit to purchase the required inputs than men
Gender related opportunities	<ul style="list-style-type: none"> The technology is acceptable and easy to upscale by all the all gender categories including women and the youth The FFBS strategy that is being used for effective training in cowpea production is inclusive of the various gender categories Opportunities for youths and women exists in cowpea production, transportation and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to land for cowpea cultivation than men VMGs may also have limited access to finances to buy the required inputs such as seeds than men VMGs have less access to agricultural information, technology and knowledge than men The laborious production practices may not be friendly to the VMGs who are differently abled VMGs may have less access to markets than men
VMG related opportunities	<ul style="list-style-type: none"> Cowpea is nutritious and well adopted in the country hence will act as a food security crop for the VMGs The technology is acceptable and easy to upscale by all the various gender categories including the VMGs Increased production will lead to increased consumption and utilization hence improved health of VMGs The FFBS strategy that is being used for effective training in cowpea production is inclusive of the VMGs Opportunities for youths and women exists in cowpea production transportation and marketing
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> Unknown
Application guidelines for users	<ul style="list-style-type: none"> Cowpea production guidelines

	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya
F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	<ul style="list-style-type: none"> • Ready for upscaling
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO-Katumani - R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Nguluu
Partner organizations	MoALFC, Universities, ICRISAT

2.5 INTEGRATED SOIL FERTILITY MANAGEMENT (ISFM)

2.5.1 Integrated Manure Management (IMM)

TIMP Name	Integrated Manure Management (IMM)
Category (i.e. technology, innovation or management practice)	Complementary technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low yields due to declining soil fertility, Poor manure management and handling
What is it? (TIMP description)	Integrated Manure Management (IMM) is the optimal, site-specific handling of livestock manure from collection, through treatment and storage up to application to crops.
Justification	<p>The decline in soil fertility in smallholder system is a major factor inhibiting agricultural development on farms. It is estimated that soils are depleted at annual rate of 8kg/acre for nitrogen, 1 kg/acre for phosphorous, and 6 kg/acre for potassium. Manure plays an essential role in the nutrient cycle where crops grow on land to feed livestock, which in return feeds the land with their manure.</p> <p>Recycling the nutrients (macro and micro) in manure reduces the need for additional fertilizer purchase. In general, adding manure to soils enhances soil fertility and soil health that leads to increased agricultural productivity, improved soil structure, increases moisture and nutrient retention and biodiversity.</p> <p>Given the acute poverty and limited access to mineral fertilizers, manure has the potential of providing the limiting nutrients and improving the soil health.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • Open and field days • Exchange visits • Demonstration farms; on station and on field • FFBS • Digital Platforms • Agriculture Innovation Platforms

Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Training on feeding, management and use of manure • Use of appropriate dissemination approaches to reach target farmers • Model demonstration plots using cereal crops
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County governments, Provide extension services, farmer mobilization and policy formulation • I LRI (International Livestock Research Institute), technical backstopping • NGOs – micro financing services
C: Current situation and future scaling up	
Counties where already promoted if any	<ul style="list-style-type: none"> • Makueni, Bungoma, Kakamega and Kitui
Counties where TIMP will be promoted	<ul style="list-style-type: none"> • Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of model demonstration farms • Lack of continuity in training of extension and farmers in the skill for manure management • Lack of proper mobilization mechanism for reaching many farmers
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establishment of many demonstration plot by counties • Continuous capacity building of demonstration farmers and extension workers • Use of appropriate approaches to mobilize farmer to attend demonstration forums
Lessons learnt if any	<ul style="list-style-type: none"> • Proper use of manures improves soil fertility • Use of manures enhances crop productivity • Need to enhance skills in manure preparation, storage and application
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Acceptance that manure increases crop yield just like inorganic fertilizer and enhances soil moisture retention • Ability to safely handle manure to reduce contamination of water sources by leaching of nutrients and increase GHG emissions. • Well-structured market channels to absorb extra crop produce to earn producers an income
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Unknown.
Estimated returns	<ul style="list-style-type: none"> • Unkwown
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crop production activities such as weeding hence the IMM may increase their work burden • Women and youth have limited access to productive resources such as land, quality cowpea seed and credit • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for and youth in IMM operations

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality cowpea seeds • 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 • It is labour intensive in terms of handling and application hence may disadvantage VMGs
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in transporting the organic fertilizer inputs and crop produce
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • Unknown
Application guidelines for users	<ul style="list-style-type: none"> • Cowpea production guidelines •
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	<ul style="list-style-type: none"> • Ready for upscaling • Requires validation
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO-Katumani - R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Nguluu
Partner organizations	MoALFC, Universities, ICRISAT

Research gaps

Promote IMM complementary technology in counties that have not practiced it.

Conduct nutrient budget study on selected farms utilizing manures (including composts) in each of the 24 Counties.

2.5.2 Integrated Soil Fertility Management (ISFM)

TIMP name	Integrated Soil Fertility Management (ISFM)
Category (i.e. technology, innovation or management practice)	Complementary technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yield due to declining soil fertility, low organic matter, poor structured soil and limited available moisture for crop use.
What is it? (TIMP description)	A set of soil management practices designed to improve and maintain soil fertility. These include a combination of fertilizers, locally available organic inputs and improved seed combined adapted s to local conditions. It places emphasis on the importance of using often scarce resources like fertilizer and organic inputs efficiently through techniques such as fertilizer banding (field application of fertilizer directly in area of root-zone to increase the potential for uptake) and micro dosing (applying small quantities of fertilizer with the seed at planting time and a few weeks after emergence). ISFM therefore aims to optimize agronomic use efficiency of the applied nutrients for improved crop productivity.

Justification	<p>Soils within the farming systems are 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.</p> <p>A large proportion of soils in the KCSAP target project counties are derived from some of the oldest land surfaces which, due to weathering and cropping, have low nutrients. Where younger, volcanic soils occur these are inherently richer in nutrients, but may have other soil fertility problems such as fixation of some critical nutrients such as phosphorus. Past management of the soils also has a major influence on soil fertility which in turn influences productivity.</p> <p>These challenges call for an integrated soil fertility management (ISFM) approach that combines appropriate interventions on soil management that include fertilizer use and crop agronomy.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Training in workshops • On-farm visits • Digital platforms • Farmer field and business schools (FFBS) • On-farm demonstrations (during FFS) • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of affordable and quality manure, fertilizers and clean planting materials • Take into account variability between farms, in terms of farming goals and objectives, size, labour availability, ownership of livestock, importance of off-farm income; and • Take into account amount of production resources (i.e. land, money, labour, crop residues) that different farming families are able to invest in.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension services; Provide link with farmers. • 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	<ul style="list-style-type: none"> • Homabay, Kisii, Bungoma and Uasin Gishu, machakos and Kitui
Counties where TIMP will be promoted	<ul style="list-style-type: none"> • Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mindset in some regions/cultures that organic manures cannot be applied on crops • Misconceptions that chemical fertilizer damage the soils
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness trainings on role of organic manures in crop cultivation • Training and awareness creation on the usefulness of fertilizer applications to clear the misconceptions about fertilizers
Lessons learnt if any	<ul style="list-style-type: none"> • For ISFM to succeed, good quality seed is required since farmers

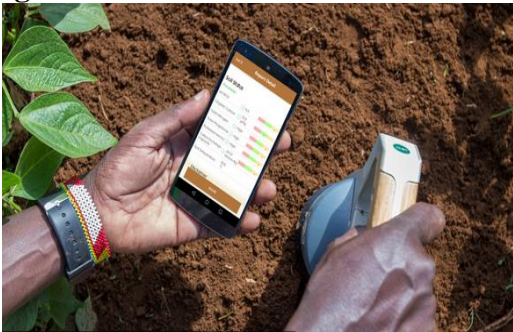
	tend to over re-use previous planted seed materials.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • That the practice is socially acceptable • The practice has no negative impact on environment • Well-structured market channels exist to offload excess produce to earn producers an income • Supporting frameworks/policies are available
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 10,000 per acre.
Estimated returns	<ul style="list-style-type: none"> • KES 8,000 per acre
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • It is labour intensive hence may not be adopted by women who are already overburdened • Women and youth have limited access to land for cowpea cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as cowpea seed than men. • 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 chores • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunity exist for youths in transportation of the fertilizer inputs and farm products • The technology is acceptable and easy to upscale by both males and female gender
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs may be physically disadvantaged for a practice that seeks to incorporate manures, etc in the farm • VMGs have limited access to land for cowpea cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as seeds than men • VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • Affirmative action in various areas as for instance in the provision of finances for farming to VMGs • Increased production will lead to increased consumption and utilization of cowpea and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • ISFM successes have been reported in sorghum and millet value chains in Machakos where productivity has increased by 20-30 %
Application guidelines for users	<ul style="list-style-type: none"> • Cowpea production guidelines
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO-Katumani - R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Ngululu

Partner organizations	MoALFC, Universities, ICRISAT
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Research gaps

- Validation of the ISFM technology in counties where technology has not been tested.
- Testing (fertilizer types, rates, frequencies) with different value chains.

2.5.3. Rapid soil testing services

TIMP Name	Rapid soil testing services  <p>Handheld scanner and mobile app monitoring soil nutrients</p>
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Limited access to soil testing services (centralized soil testing laboratories and cost).
What is it? (TIMP description)	This is a quick, dry method for soil testing that gives results immediately. It can be applied quickly and easily in remote areas far from any soil laboratory.
Justification	Soil testing is the basis for good fertilizer management that maintains the productivity of soil and improves the quality of crops. It promotes more efficient fertilizer use and prevents environmental pollution from excess fertilizer application, and cost efficiency. However, limited access to soil testing services is depriving the farmers' ability to make informed decisions with regard to soil management and fertilizer use. Conventional methods for soil testing are not cheap to farmers, results take long and not are reproducible. The method provides solutions for paired soil and leaf testing to determine health of soil and crop simultaneously. It also provides a framework for large scale assessment of geo-referenced sampled points using standardized protocols.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, Extension officers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Farmer visits • Training in workshops • FFBS • Digital platforms • Agriculture Innovation Platforms • Publicity campaigns done at County levels.
Critical/essential factors for	<ul style="list-style-type: none"> • Availability of the necessary equipment for rapid on the spot soil

successful promotion.	<ul style="list-style-type: none"> testing. Established rapport between farmers and the technical personnel involved in soil testing. Adequate qualified staff to cover the large number of samples from the target 24 counties before the planting season begins. A well-designed storage system for keeping information obtained at farm level including (GPS readings, physical description of the locations, raw measured scanned data and fertilizer recommendation according to crop type suitability). Availability a van to mount the equipment. Farmers must understand, trust, and be willing to act upon the information provided
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> County government extension services; providing the link to farmers given that agriculture is devolved. Soil Cares; Provides soil scanners technology and capacity building in collaboration with KALRO and ICRAF, ICRAF and iSDA tests and validates the recommendation obtained in collaboration with SoilCares and KALRO. Fertilizer companies; To provide fertilizer blends according to soil health status Agro dealers to stock required fertilizers that is readily available to farmers
<ul style="list-style-type: none"> C: Current situation and future scaling up 	
Counties where already promoted	<ul style="list-style-type: none"> Kiambu, Murang'a, Siaya and Kakamega
Counties where TIMP will be up scaled	<ul style="list-style-type: none"> Turkana
Challenges in dissemination	<ul style="list-style-type: none"> It requires continuous updating methods to improve recommendations. Lack of awareness on the importance of regular testing of soil quality
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Awareness creation, intensive farmer field training (capacity building) Make the whole process cost efficient. Use of scanners (spectroscopy) and less wet chemistry analysis. Automated pipelines for updating existing recommendation methods.
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> Timely affordable soil information will guide on fertilizer use. Farmers have reported frustration when they apply the wrong fertilizers and see no results because they did not take the first step to understand what the soil demand in terms of macro, micro nutrients and trace elements like Zinc and Sulphur.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> Socially acceptable-brings income, increases food production, nutrition security and family cohesion. Environmentally friendly-farmers only apply the required amounts of fertilizers. No excess nutrients to contaminate ground and surface water. Increased productivity will provide supply to the markets

	<ul style="list-style-type: none"> Supporting frameworks/policies are available.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> KES 1,000 – 5,000 for each soil sample depending on service provider
Estimated returns	<ul style="list-style-type: none"> Correction of soil nutrient deficiencies arising from results of RSTK will give a 30% increase on farm returns
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> Women and youth have limited access to land for cowpea cultivation than men Women and youth may also have limited access to finances to buy the required inputs such as seeds than men. 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> Employment opportunity exist for youth in soil sampling and testing for the local community Cash generated from cowpea production by the various gender categories can be ploughed back in other agricultural enterprises. The technology is acceptable and easy to upscale by both males and female gender
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to land and may not benefit much from RSTK services VMGs may also have limited access to finances to pay for RSTK services Women have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> This TIMP that will bring soil testing services nearer to this group of farmers and therefore is a saving and is expected to improve productivity Increased production will lead to increased consumption and utilization of cowpea and hence ensuring food security of the VMGs
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> Has been tested used successfully by other organizations like ICRAF, Soil Cares and Kenya Sugar Research Foundation (KESREF). It has been adopted at Kenya cane testing centre for checking maturity level and quality of sugarcane.
Application guidelines for users	<ul style="list-style-type: none"> KALRO NARL-Kabete County approved soil testing service providers. Universities CGIAR Research Organizations
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	<ul style="list-style-type: none"> Requires validation
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO secretariat
Lead organization/scientists	KALRO; C. Kibunja, A. Sila, D. Kamau, A.O. Esilaba, F.M. Wandera


Partner organizations	County governments in the 24 counties, Soil Cares, ICRAF and iSDA
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Research gaps:

- Lack of adequate information on site specific paired soil and crop samples to determine nutrients in the soil and what is available to plant.
- Inadequate information on site specific nutrient deficiency for recommendations for the type of fertilizer to use and at what rate.
- Developing a fertilizer recommendation system with options for new blends.
- Inadequate information to enable fertilizer companies to produce fertilizer blends packaged in smaller quantities per farmer needs.
- Lack of capacity for undertaking fertilizer quality analysis, (e.g. quantitative and qualitative analysis, major and trace elemental analysis, and chemical and physical analysis) at farm level.
- Inadequate information of current soil status for updating existing soil maps with newly acquired soil data to provide current soil fertility status in the country.

2.6 SOIL AND WATER MANAGEMENT

2.6.1. Contour bunds

TIMP Name	Contour bunds 
	Contour band
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yield due to high risk of soil erosion and increased run off from torrential rains, low soil water retention capacity of soils in dryland ecosystems
What is it? (TIMP description)	This is the laying points of equal elevation of stone or soil along the contour of a sloping field followed by constructing a bund or barrier along the contour. Making furrows parallel to the contours ensures that rainfall and runoff are spread evenly over a field. The earthen bund is formed by excavating a channel and creating a small ridge on the downhill side. Thus, contour bunds resemble narrow channel terraces commonly referred to as “ <i>fanya chini</i> ” terraces. The technology is highly suitable for areas with unpredictable rains especially the drought-prone areas (ASALs).
Justification	The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs. Contour bunds resemble narrow channel

	terraces commonly referred to as “ <i>fanya chini</i> ” terraces. The aim of contour bunds and hedgerows is to concentrate moisture into the ridge and furrow area where the crops are planted by trapping run off water from the catchment area between them. This also decreases the risk of erosion. Plants with higher water requirements, such as peas or beans, can be planted on the higher side of the furrow whereas fruit crops requiring less water, such as cowpea, can be planted on the ridges.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations during farmer field schools • Training in workshops. • FFBS • Digital platforms • Agriculture Innovation Platforms
Most effective approach	<ul style="list-style-type: none"> • Model farm demonstration
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct contour bunds. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Busia, Kisumu, Elgeyo Marakwet, Bungoma and Makueni
Counties where TIMP will be promoted	Turkana
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Increased risk of soil erosion if contours are improperly laid out • Labour intensive and many farmers may find it difficult to implement at large scale • Land tenure systems – communal land ownership, or in places where individuals don’t have land title deeds
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate equipment for preparation of Contour for efficiency and increased output per man hour. • Training youthful farmers to be champions of Contour bunds construction at the Ward level/village level. • Training on site specific designs and construction of contour bunds • Fast-track land registration
Lessons learnt, if any	<ul style="list-style-type: none"> • Terracing is popular due largely to the rapid benefits it gives in terms of improved crop performance. • Existence of well-developed self-help groups can lead to successful soil and water conservation activities.

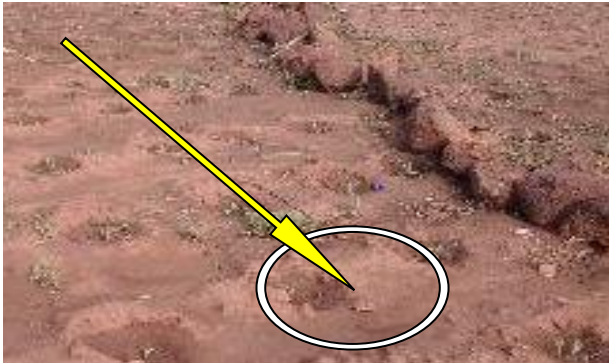
	<ul style="list-style-type: none"> • Conducting well publicized campaigns has been found to add to the success of soil and water conservation. • Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low-cost technologies for soil and water conservation • Policies that support individual land tenure systems
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 20,000 per acre mainly through the labour costs during establishment of the contour bunds. Subsequent years a lower cost of maintaining the structures is incurred.
Estimated returns	KES 6000 per acre and likely to increase in subsequent years as the only cost incurred is for maintenance of the structures.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to land for cowpea cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as farm implements than men. • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunity exist for youth in performing the operations • Cash generated from cowpea production by the various gender categories can be ploughed back in other agricultural enterprises. • The technology is acceptable and easy to upscale by both males and female gender
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for cowpea cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as farm implements than men. • Some VMGs may not attend extension activities due to their disability or their advanced age • Some VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • Application of contour ridge is expected to improve agriculture production thus, more food and income for the VMGs. • Increased production will lead to increased consumption and of cowpea and hence ensuring food and nutritional security of the VMGs

E: Case studies/profiles of success stories		
Success stories, if any	<ul style="list-style-type: none"> • Ngangani, Yatta Sub County-Machakos County 	
Application guidelines for users	<ul style="list-style-type: none"> • Cowpea production guidelines • Journal papers- East African Journal (Agroforestry and Agriculture) • Conference Proceedings- Dryland Farming Systems 	
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)		Ready for upscaling
G: Contacts		
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos	
Lead organization/scientists	KALRO, R Wangari, A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Nguluu	
Partner organizations	MoALFC, Universities, ICRISAT	

Research gaps

- Develop site specific designs for construction – validation in other regions
- Conduct trade off analysis (economic analysis) of contour bunds as a soil and water management technology in the various AEZs and along specific value chains
- Develop low-cost mechanized tools to ease labor demands in contour construction and maintenance

2.6.2. Zai Pits


TIMP Name	Zai Pits  Zai pits combined with stone rows
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Decreased yields due to inadequate and unreliable water to sustain a crop as a result of high seasonal rainfall variability leading to total crop failures. .
What is it? (TIMP description)	<i>Zai Pits</i> are small dug out depressions used for harvesting and storing water for prolonged crop use. The pits typically measure 15-30 cm in

	width, 10-20 cm deep and are spaced at 60-80 cm. Farmers plant seeds into the pits after filling one to three handfuls of organic material such as manure, compost, or dry plant biomass. The technology is highly suitable for areas with unpredictable rains especially the drought-prone areas (ASALs).
Justification	The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs. <i>Zai Pits</i> technology has the potential to harvest and store rain water for prolonged crop use. This technology also contributes to improving the management of degraded lands, reducing soil erosion, vegetation loss and biodiversity as well as crop yield.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations during farmer field schools • Training in workshops. • FFBS • Digital platforms • Agriculture Innovation Platforms
Most effective approach	<ul style="list-style-type: none"> • Model farm demonstration
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service provide requisite skills to design and construct <i>Zai</i> pits. • Availability of affordable organic matter i.e. manure, compost.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension services –delivery of information inputs to farmers. • Community farmer groups – Provide on-farm demonstration plots to hold farmer field schools • NGOs – capacity building, policy support in soil and water conservation issues
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Turkana
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • The greatest challenge is that the technology is labour intensive and many farmers may find it difficult to implement at large scale. • Inadequate knowledge on designing and maintaining <i>Zai</i> Pits
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate equipment for preparation of <i>Zai</i> pits for efficiency and increased output per man hour. • Training youthful farmers to be champions of <i>Zai</i> pits construction at the Ward level/village level.
Lessons learnt, if any	<ul style="list-style-type: none"> • The technology has huge potential to increase farmers' resilience especially in ASALs. Similarly, when the farmers are

	adequately trained and sensitized on the technology, many of them would be willing to invest in it to maximize yields.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforcement of policies on soil and water conservation at the County level • Creation of awareness on the importance of soil and water conservation • Provision of low-cost technologies for soil and water conservation • Policies that support individual land tenure systems • Provision of financial support for establishment of the <i>Zai</i> pits
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Labour costs incurred in the first year for establishment of <i>Zai</i> pits is between KES 25 000-40,000 per acre, which decrease considerably in subsequent years where the cost incurred is for maintaining the structures
Estimated returns	KES 15,000 per acre in first year but increased in subsequent years as only maintenance cost is required. Well maintained <i>Zai</i> pits enable the farmer get higher yields hence an income of between KES. 5,000 and 41,000 from grain.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • It is labour intensive in terms of preparation and application hence may not be adopted by women who are already overburdened • Women and youth have limited access to land for cowpea cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as seeds than men. • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunity exist for youth during implementation • The technology is acceptable and easy to upscale by both males and female gender
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for cowpea cultivation than men • The technology involves carrying of heavy manure to the field during establishment which may be difficult for the physically weak VMGs. • VMGs may also have limited access to finances to buy the required inputs such as seeds than men • Women have less access to agricultural information, technology and knowledge than men • The technology is labour intensive and may be difficult for the VMG to implement in the field
VMG related opportunities	<ul style="list-style-type: none"> • Application of ZAI pits is expected to improve agriculture production thus, more food and income for the VMGs • Increased production will lead to increased consumption and

	utilization of cowpeas and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories, if any	<ul style="list-style-type: none"> Two women groups in Kiliki, Matungulu sub-County of Machakos County through a representative Janet Ndunge reported having started using the <i>Zai pit</i> farming technology in 2013 after attending a farming workshop by the Institute for Culture and Ecology (ICE). “Ever since we started using <i>Zai pits</i>, we have seen an increase in our harvests as compared to the conventional methods of farming,” she said. Farmers in Kathonzweni, Makueni County increased dug pits from 170 to 500 pits for crop production due to initially observed benefits. Communities in ASALs have also rehabilitated degraded lands and increased production by many folds.
Application guidelines for users	<ul style="list-style-type: none"> Cowpea production guidelines Journal papers- East African Journal (Agroforestry and Agriculture) Conference Proceedings- Dryland Farming Systems
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO, R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Nguluu
Partner organizations	MoALFC, Universities, ICRISAT

2.6.3. Bench terraces


TIMP Name	Bench terraces 
	Bench Terrace
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yield as result of soil erosion and increased run off; low soil

	water retention capacity in most soils. Increased contamination of water bodies by organic and mineral debris
What is it? (TIMP description)	<p>Bench terraces consist of a series of beds which are more or less level running across a slope at vertical intervals, supported by steep banks or risers (walls or bunds).</p> <p>The flat beds created by bench terraces enable the cultivation of crops on medium to steep slopes. The technology is highly suitable for Semi-arid to humid regions of rainfall, 700 mm or more; medium to steep slopes (12- 47%) (Bench terraces are not recommended for slopes less than 12%); soil depth of greater than 50 cm; and areas with no gullies, nor stones.</p>
Justification	Agricultural production is threatened in many parts of the Kenya by soil erosion and limited soil moisture. Conservation of soil and moisture through construction of terraces has led to better and more reliable crop yields especially in the ASALs counties of Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations during farmer field schools • Training in workshops. • FFBS • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct contour bunds. • Land tenure systems that allows individual ownership (land)
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Turkana
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Increased risk of soil erosion if terraces are improperly laid out • Labour intensive during construction and maintenance and many farmers may find it difficult to implement at large scale • Land tenure systems – communal land ownership, or in places where individuals don't have land title deeds
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate equipment for preparation of Bench terrace for efficiency and increased output per man hour. • Training youthful farmers to be champions of making bench terraces construction at the Ward level/village level. • Training on site specific designs and construction of bench

	<p>terraces</p> <ul style="list-style-type: none"> • Fast track land registration
Lessons learnt, if any	<ul style="list-style-type: none"> • Terracing is popular due largely to the rapid benefits it gives in terms of improved crop performance. • Existence of well-developed self-help groups can lead to successful soil and water conservation activities. • Conducting well publicized campaigns has been found to add to the success of soil and water conservation effort. • Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low-cost technologies for soil and water conservation • Policies that support individual land tenure systems
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main input cost is the labour for <i>Bench terrace</i> preparation. The cost will depend on the land size, labor costs and the landscape terrain/slope
Estimated returns	The main input cost is the labour for <i>Bench terrace</i> preparation. The cost will depend on the land size, labor costs and the landscape terrain/slope
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Labour costs incurred in the first year for establishment of bench terraces is between KES 25 000-40,000 per acre, which decrease considerably in subsequent years where the cost incurred is for maintaining the structures
Gender related opportunities	<ul style="list-style-type: none"> • Bench terrance technology is labour intensive therefore may increase women work burden • Women have less access to agricultural information, technology and knowledge • Women and youth have limited access to productive resources such as land, quality seet potato cuttingsand credit • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Potential to create employment for youth through provision of the labour required
VMG related opportunities	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seet potato cuttings • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from

	<p>decision making in development and dissemination activities</p> <ul style="list-style-type: none"> • There is low adoption by VMGs due lack of awareness
E: Case studies/profiles of success stories	
Success stories, if any	<ul style="list-style-type: none"> • Mukethe Mbithi is a member of the Kyungu Mwethya group in Machakos • "Before making the bench terraces we didn't have good harvests because the soil was eroded. When we put fertilizer on, the water washed. But when we made terraces the soil erosion stopped and we got good crops. So, I encourage other farmers especially in dry areas to try this new technology for their crops"
Application guidelines for users	<ul style="list-style-type: none"> • Cowpea production guidelines • Journal papers- East African Journal (Agroforestry and Agriculture) • Conference Proceedings- Dryland Farming Systems
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO, R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Ngulu
Partner organizations	MoALFC, Universities, ICRISAT

2.6.4. Fanya Juu Terraces


TIMP Name	<p>Fanya Juu Terraces</p>  <p>Fanya Juu</p>
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields due to soil erosion, increased run off; low soil water retention capacity
What is it? (TIMP description)	'Fanya juu' terraces (juu is a Swahili word for 'up' or upward) is a soil barrier constructed by excavating soil and throwing it up-slope to make

	<p>an embankment. are The embankment forms a runoff barrier and the trench (ditch) is used to retain or collect runoff.</p> <p>The embankments are usually stabilized with fodder grasses. Crops, such as cowpea may then be grown in the ditches. Through gradual redistribution of soils within the field, the terraces level off.</p> <p>The technology is highly suitable in low rainfall areas (less than 700 mm annually); moderate slopes (less than 20%); deep soils (more than 60 cm); and hilly areas that are subject to widespread erosion.</p>
Justification	<p>The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs.</p> <p>Agricultural production is threatened in many parts of the Kenya by soil erosion and limited soil moisture.</p> <p>Conservation of soil and moisture through construction of terraces has led to better and more reliable crop yields especially in the ASALs counties of Kenya.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations during farmer field schools • Training in workshops. • FFBS • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct Fanya juu. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools. • NGOs and private service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Turkana
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Increased risk of soil erosion if terraces are improperly laid out • Labour intensive and many farmers may find it difficult to implement at large scale • Land tenure systems – communal land ownership, or in places where individuals don't have land title deeds
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate equipment and information for preparation of terraces for efficiency and increased output per man hour. • Training youthful farmers to be champions of 'fanya juu' terraces

	<p>construction at the Ward level/village level.</p> <ul style="list-style-type: none"> • Training on site specific designs and construction of ‘fanya juu’ terraces • Fast-track land registration
Lessons learnt, if any	<ul style="list-style-type: none"> • ‘Fanya juu’ terracing is popular due largely to the rapid benefits it gives in terms of soil and water conservation. • Existence of well-developed self-help groups can lead to successful soil and water conservation activities. • Conducting well publicized campaigns has been found to add to the success of soil and water conservation. • Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low-cost technologies for soil and water conservation • Policies that support individual land tenure systems
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Labour costs incurred in the first year for establishment of <i>fanya-juu terraces</i> is between KES 25 000-40,000 per acre, which decrease considerably in subsequent years where the cost incurred is for maintaining the structures
Estimated returns	KES 15,000 per acre in first year but increased in subsequent years as only maintenance cost is required
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The technology is labour intensive therefore may increase women labour burden • Women have less access to agricultural information, technology and knowledge • Women and youth have limited access to productive resources such as land, quality seed and credit • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Potential to create employment for youth through provision of the labour required for construction of structures
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • The technology is labour intense and may be difficult for the VMG to implement in the field. • The labour cost of adopting this technology might be out of reach for the VMGs thus affecting adoption and scaling up • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs • 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

VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in provision of labour for construction of erosion control structures • VMGs could be beneficiaries of increased crop productivity which enhances food and nutritional security
E: Case studies/profiles of success stories	
Success stories, if any	<ul style="list-style-type: none"> • Over 50,000 smallholder farmers in lower Eastern counties of Kenya are recording a more than doubling of yields and reduced soil erosion after embracing a soil conservation scheme that involves digging of trenches in hillside to trap runaway water and soil.
Application guidelines for users	<ul style="list-style-type: none"> • Cowpea production guidelines • Journal papers- East African Journal (Agroforestry and Agriculture) • Conference Proceedings- Dryland Farming Systems
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	
Ready for upscaling	
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO, R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Nguluu
Partner organizations	MoALFC, Universities, ICRISAT

2.6.5. Stone lines


TIMP Name	Stone lines 
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields due to soil erosion, increased run off; low soil water retention capacity in most cultivated soils
What is it? (TIMP description)	Stone lines are an arrangement of stones placed along contour lines to slow down runoff. With time, the soil builds up on the upslope side of the stone line and a natural terrace is formed. The technology is suitable

	in gentle to moderate slopes (less than 10%); areas with low annual rainfall areas (200 - 750 mm); and on stony areas
Justification	<p>The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs.</p> <p>Agricultural production is threatened in many parts of the Kenya by soil erosion and limited soil moisture. Stone lines can help in the conservation of soil and moisture.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations during farmer field schools • Training in workshops. • FFBS • Digital platforms • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct stone lines. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Availability of County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools; provide collective labor. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos,, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Turkana
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Increased risk of soil erosion if stone lines are improperly laid out • Labour intensive and many farmers may find it difficult to implement at large scale • Land tenure systems – communal land ownership, or in places where individuals don't have land title deeds
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate tools for preparation and laying of stones lines for efficiency and increased output per man hour. • Training youthful farmers to be champions of laying stone lines and maintenance. • Training on site specific designs and laying of stone lines • Fast-track land registration
Lessons learnt, if any	<ul style="list-style-type: none"> • Existence of well-developed self-help groups can lead to successful construction of stone lines. • Conducting well publicized campaigns has been found to add to the success of soil and water conservation. Similarly, when the

	farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low cost technologies for soil and water conservation • Policies that support individual land tenure systems • Well-structured market channels to offload excess produce to earn producers some income
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • For each acre, transport and other project costs amount to around KES 25,000, which decrease considerably in subsequent years where the cost incurred is for maintaining the structures
Estimated returns	<ul style="list-style-type: none"> • KES 10,000 in first year and increase in subsequent years as there is need to meet maintenance cost only
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The technology is labour intensive therefore may increase women labour burden • Women have less access to agricultural information, technology and knowledge • Women and youth have limited access to productive resources such as land, quality seed and credit • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Potential to create employment for youth through provision of the labour required • Women and youth beneficiaries of increased productivity which enhances food and nutritional security
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • 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
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth in provision of labour • VMG members could be beneficiaries of increased productivity which enhances food and nutritional security
E: Case studies/profiles of success stories	
Success stories, if any	<ul style="list-style-type: none"> • In Burkina Faso farmers have reported doubled cereal production when stone lines are used in combination with greater use of compost as fertilizer. https://www.rural21.com/fileadmin/migrated/content/uploads/Stone_lines_against_desertification_01.pdf

Application guidelines for users	<ul style="list-style-type: none"> • Cowpea production guidelines • Journal papers- East African Journal (Agroforestry and Agriculture) • Conference Proceedings- Dryland Farming Systems
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	<ul style="list-style-type: none"> • Ready for upscaling
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO-Katumani - R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Nguluu
Partner organizations	MoALFC, Universities, ICRISAT


2.6.6. Grass strips

TIMP Name	Grass strips 
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yield due to soil erosion and increased run off
What is it? (TIMP description)	Grass strips are dense strips of grass planted up to a meter wide, along a contour. With time, silt builds up above the strip and benches are formed. Grass strips can be planted along ditches to stabilize them, or on the rises of bench terraces to prevent erosion. They are a popular and easy way to terrace land, especially in areas with relatively good rainfall.
Justification	Agricultural production is threatened in many parts of the Kenya by soil moisture stress and serious soil erosion. Conservation of soil and moisture through construction of grass strips has led to better and more reliable crop yields. The technology is suitable in regions with fairly gentle slopes (0 - 6%); grass is needed for fodder; and high rainfall areas.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers
Approaches to be used in	<ul style="list-style-type: none"> • On-farm demonstrations during farmer field schools

dissemination	<ul style="list-style-type: none"> • Training in workshops. • FFBS • Agriculture Innovation Platforms • Digital platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour • Availability of land, apart from cropland. • Farmers and extension service with skills to design and plant grass lines. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools; provide collective labor. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Turkana
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Labour intensive for maintaining and controlling grass from becoming a weed • Reduced land area for crop production
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate tools and suitable grass varieties. • Capacity building on the maintenance of grass strips. • Training on site specific designs and layout
Lessons learnt, if any	<ul style="list-style-type: none"> • Establishment of grass strips induces a process of natural terracing on slopes as soil collects behind the grass barrier, even in the first year. • Grass strips can be very appropriate for farmers who cut and carry fodder for their animals. • Grasses are also used as mulch for crops by farmers.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low-cost technologies for soil and water conservation • Existence of well-structured markets to offload extra produce to earn an income
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<p>KES 5000 per acre</p> <p>Labour and seed costs incurred in the first year for establishing the grass strips is approximately KES 5,000 per acre. In the subsequent years, maintenance comprises labour cost for weeding and cutting the grass for livestock.</p>
Estimated returns	KES 3000 per acre>Returns increases in later years as the grass

	harvested from strips adds to investor returns
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The technology is labour intensive therefore may increase women labour burden • Women have less access to agricultural information, technology and knowledge • Women and youth have limited access to productive resources such as land, quality seed and credit • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Potential to create employment for youth through provision of the labour required • Women and youth likely beneficiaries of increased productivity through enhanced food and nutritional security
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • The technology is labour intense and may be difficult for the VMG to implement in the field. • The labour cost of adopting this technology might be out of reach for the VMGs thus affecting adoption and scaling up • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs • 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
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth exists in provision of paid labour • VMG members likely beneficiaries of increased productivity through enhanced food and nutritional security
E: Case studies/profiles of success stories	
Success stories, if any	-
Application guidelines for users	<ul style="list-style-type: none"> • Cowpea production guidelines • Journal papers- East African Journal (Agroforestry and Agriculture) • Conference Proceedings- Dryland Farming Systems
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	Institute Director KALRO-AMRI Katumani P.O. 340, 90100 Machakos
Lead organization/scientists	KALRO, R Wangari A Njaimwe, J Wambua, P Kathuli, E Gichangi, A M Kilewe, S. N Nguluu
Partner organizations	MoALFC, Universities, ICRISAT

2.6.7. Tied ridges

TIMP Name	Tied ridges 
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yield due to crop water stresses emanating from low, erratic and unreliable rainfall, especially in the ASALs
What is it? (TIMP description)	Tied ridges are small earthen ridges, 30 cm high, with an upslope furrow which accommodates water between the ridges. The technology consists of water flowing down the small trenches/furrows running parallel and infiltrates into crop root zones. Water is applied to the top end of each furrow and flows down the crop field under the influence of gravity.
Justification	<p>With limitations in soil moisture due to decreasing rainfall occasioned by climatic changes, tied ridges helps conserve soil moisture for crop use.</p> <p>When used in combination with furrow irrigation, the technology has potential to improve agricultural productivity and increase crop yields and cropping intensities. As a result, household food security, incomes and livelihoods are enhanced.</p>
Region promoted	Tana River, Garissa, West Pokot counties
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • Agricultural Trade Fairs • Chief's Baraza • Farmer Field and Business Schools (FFBS), • On-farm and on-station demonstrations, • Field Days • Digital platforms • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Proximity to water sources - close to permanent water sources • Suitable topography of area (level land) • Availability of technical capacity for maintenance
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government – capacity building • Private sector – access to credit, capacity building • NGOs (Kenya Red Cross (KRC), Action Aid, World Vision, and


	<p>OXFAM) – capacity building, credit facilities, facilitate technology access</p> <ul style="list-style-type: none"> • National Irrigation Board – technology access and capacity building • Water Resources Management Authority – Water resources use management
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Can be labour intensive during establishment phase • Poor management may lead to water use inefficiencies • Limited access to credit may limit uptake • Land tenure insecurity in some counties limits adoption and investments
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Enhancing farmers’ capacity to construct and maintain the structures • Enhance access to credit • Implement policy on land use and tenure
Lessons learnt	<ul style="list-style-type: none"> • Use of tied ridges with furrow irrigation significantly increases yields • Poor management and designs may often result in flooding of low areas • Assessment of soil erosion and sediment is key to sustainability
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • The economics of furrow irrigation needs to be well articulated • Requires enhanced land quality control to mitigate against soil salinity • Adequate policies and guidelines regarding water abstraction from the main water sources to minimize resource conflicts especially along river downstream. • Market for the crops produced under irrigation should be identified early enough to minimize losses and increase profitability from the system
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Labour costs incurred in the first year for establishment of tied ridges are approximately KES.15,000 per acre, which decrease considerably in subsequent years where the cost incurred is for maintaining the structures
Estimated returns	KES 10,000 per acre and returns increase with time as only maintenance cost is required
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • It is labour intensive in terms of preparation and application hence may not be adopted by women who are already overburdened • Women and youth have limited access to land for cowpea cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as high quality seed than men.

	<ul style="list-style-type: none"> • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunity exist for youth during implementation • The technology is acceptable and easy to upscale by both males and female gender • Both men and women likely beneficiaries of increased productivity as it enhances food and nutritional security
VMG related concerns	<ul style="list-style-type: none"> • VMGs have limited access to land for cowpea cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as seeds than men • The technology is labour intensive and may be difficult for the VMG to implement in the field
VMG related opportunities	<ul style="list-style-type: none"> • 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 cowpeas and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • There are successful models for such technology i.e. Mwea and Perkerra irrigation schemes where furrow irrigation systems have provided opportunities for local community to produce high value crops.
Application guidelines for users	<ul style="list-style-type: none"> • RELMA Technical Handbook Series 24. Nairobi, Kenya: Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency, (Sida). 60 p. + x p.; includes bibliography • FAO CSA Manual • FAO Irrigation Water Management: Irrigation Manual • GoK MoALFC: Training Manual for Water Users Association and farmers
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	
Ready for upscaling	
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO; J. Mwaura, I. Sijali
Partner organizations	National Irrigation Board (NIB), Water Resources Management Authority (WARMA)

Research gap

The economic viability of the technology in different agroecological zones need to be done

2.6.8. Conservation Agriculture

TIMP Name	Conservation Agriculture 
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed:	<p>Low crop yield due to land degradation characterized by the declining soil fertility, increased soil moisture stress, increased soil erosion and loss of biodiversity.</p> <p>Increased GHGs emissions from continuous land operation</p>
What is it? (TIMP description)	<p>Conservation agriculture is management practice in which there is minimal disturbance of the soil prior to and after planting. It maximizes on saving water on the farming by adhering to specific principles that govern it which target to conserve the soil, soil moisture, and soil-nutrients, and stabilize land production while reducing production costs.</p> <p>Conservation agriculture principles are: 1. Minimal soil disturbance, 2. Permanent ground cover - maintenance of a mulch of carbon-rich organic matter covering and feeding the soil (e.g. straw and/or other crop residues including cover crops), 3. Crop rotation or sequences and associations of crops including trees, which could include nitrogen-fixing legumes</p>
Justification	<p>Conservation agriculture (CA) enhances management of soil fertility and organic matter, and improvement of the efficiency of nutrient inputs, helping to produce more with proportionally less fertilizer.</p> <p>Rotations and crop associations that include legumes are capable of hosting nitrogen-fixing bacteria in their roots; this contributes to optimum plant growth without increased GHG emissions induced by fertilizer production</p> <p>Avoidance of tillage minimizes occurrence of net losses of carbon dioxide by microbial respiration and oxidation of the soil organic matter and builds soil structure and bio pores through soil biota and roots</p> <p>The protective soil cover of leaves, stems and stalks from the previous crop shields the soil surface from heat, wind and rain, keeps the soil cooler and reduces moisture losses by evaporation</p> <p>Conservation agriculture reduces soil compaction and plough pans and regenerates degraded lands</p>

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Agents, Researchers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Agricultural Trade Fairs • Chief's Baraza • Farmer Field and Business Schools (FFBS), • On-farm and on-station demonstrations, • Field Days • Digital platforms • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Adequate training on principles and benefits of conservation agriculture • Establishment of Model demonstration using crops
Partners/stakeholders for scaling up, their roles and stage of involvement	<ul style="list-style-type: none"> • County Extension officers - Dissemination of information, capacity building • NGOs (African Conservation Network, One Acre Fund)- Capacity Building, Dissemination of information • CIAT, FAO – capacity building • County Governments - Funding conservation agriculture activities, support capacity building, enabling environment and supportive policies
<ul style="list-style-type: none"> • C: Current situation and future scaling up 	
Counties where already promoted if any	Bungoma, Meru, Embu, Tharaka Nithi, Laikipia, Kakamega
Counties where TIMP will be upscaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Non-availability of crop residue in high quantities • Competition for crop residues with other uses like wood fuel and livestock feed • Land tenure (farmers reluctant to invest in conservation agriculture where they do not have clear land rights) • Limited knowledge on the incremental benefits of conservation agriculture • Limited access to conservation agriculture implements
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Ensure at least 30 % residue retention on farmlands • Enact policies that subsidize use of fossil fuel and solar usage at household level • Enhance land tenure registration • Improve KALRO and County government capacity to train and re-tool technical team so as to enhance uptake of the technology • Allocation of more funds for continued research and dissemination of this technology would aid increased uptake of conservation agriculture with agroforestry • Enhance Public Private Partnerships (PPP) to support increased production and market access
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Uptake of conservation agriculture increases with the realized incremental benefits over time • Continuous capacity building increases conservation agriculture uptake


Social, environmental, policy and market conditions necessary for development and dissemination	<ul style="list-style-type: none"> • Develop Integrated Herbicide Management Plan – pre-emergence and post-emergence herbicides • Reliable technology adoption and suitable price and market access for produce under conservation agriculture • Continuous capacity building of the community on the benefits of conservation agriculture • County policies that support households investing in conservation agriculture with inputs like implements
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Costs related to ripping services and herbicides amount to KES 5000/acre. This is apart from the normal inputs of seed and fertilizer when establishing. But the costs of reduce over the years, while the returns increase
Estimated returns	Reduction of costs associated with tillage-induced soil erosion and degradation i.e., 40% of land degradation KES 15,000 per acre and increases over the years
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The technology may reduce women work burden when it comes to weeding • Women have less access to credit land than men • Women and youth have limited access to the equipment used for conservation agriculture than men • Women have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunity for youths and women in performing the operation • Conservation agriculture is a management practice that is friendly for all the gender categories
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The technology will reduce VMGs work burden when it comes to weeding • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit and quality seed • 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
VMG related opportunities	<ul style="list-style-type: none"> • Increased production will lead to increased consumption and utilization of Cowpeass hence improved health of VMGs • With less time engagement in the farm, VMGs would find more time to engage in other economic activities
• E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers and agro-pastoralists who adopt the technology have had sustainable source of income and increased resilience
Application guidelines for users	<ul style="list-style-type: none"> • Climate-Smart Agriculture: Training Manual for Agricultural Extension Agents in Kenya.

	<ul style="list-style-type: none"> • KCEP-CRAL CSA Extension Manual • SUSTAINET EA 2010. Technical Manual for farmers and Field Extension Service Providers: • Conservation Agriculture. Sustainable Agriculture Information Initiative, Nairobi
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO, E. Mutuma
Partner organizations	County government, Private Public Partnerships

Research gaps

1. Identification of the most suitable diversified crop rotations and suitable crops for biomass for the different counties.
2. Development of suitable conservation agriculture implements/field equipment prototypes.
3. Capacity building on the benefits and operationalization of Conservation Agriculture systems – both among extension and technical staff, and at decision-making levels

2.6.9. Cowpea/cereal intercropping

TIMP Name	Cowpea – Legume/cereal intercropping 
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed:	Decreased yields due to declining soil fertility as a result of soil erosion and degradation
What is it? (TIMP description)	<p>Intercropping is a multiple cropping practice involving growing two or more <u>crops</u> together.</p> <p>Single row intercropping: involves the component cowpea and the cereal arranged in alternate single rows.</p> <p>The space between the two cowpea rows is 150cm and the cereal is planted in between so that between legume and cereal row is 100cm.</p>

	<p>Strip intercropping: multiple rows, or a strip, of the legume is alternated with single or several rows of sorghum.</p> <p>Spacing. The inter row spacing between legume is 100cm and legume to cowpea is 100 cm. The space between two cowpea rows is 100cm.</p> <p>Control of pest through intercropping</p> <p>Push-pull cropping, this is a mixture of trap cropping and repellent intercropping. An attractant crop attracts the pest and a repellent crop is also used to repel the pest away.</p> <p>Trap cropping, this involves planting a crop nearby that is more attractive for pests compared to the production crop, the pests will target this crop and not the production crop.</p> <p>Repellent intercrops, an intercrop that has a repellent effect to certain pests can be used. This system involved the repellent crop masking the smell of the production crop in order to keep pests away from it.</p>
Justification	<p>Intercropping is one of the potential management practices for enhancing climate change adaptation. It offers the potential to increase yield, enhance soil fertility/biodiversity and minimize the effects of climate change.</p> <p>The practice is known to build healthy soils, control pests and harness a variety of benefits to increase yields. Intercropping of compatible plants encourages biodiversity by providing a habitat for a variety of insects and soil organisms that would not be present in a single-crop environment.</p> <p>Intercropping has several advantages. First, an intercrop may use resources of light, water, and nutrients more efficiently than single crops planted in separate areas, and this can improve yields and income. Secondly, crop mixtures frequently have lower pest densities, especially of insect pests. This occurs both because the mixture confuses the insects and, if chosen carefully attracts beneficial predators. Finally, intercropping may allow more effective management of cover crops.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers and value chain stakeholders
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Agricultural Trade Fairs • Chief's Baraza • Farmer Field and Business Schools (FFBS), • On-farm and on-station demonstrations, • Field Days • Digital platforms • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Awareness creation on the benefits and contribution of the practice to all stakeholders. • Easy access of cereal varieties that are compatible with cowpea • Technical packages describing appropriate schedules of planting intercrop. • Package on fertilizer rates and regimes under the practice.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County governments – to provide extension services, farmer mobilization and policy formulation • NGOs – to provide support on capacity building and micro-financing services

C: Current situation and future scaling up	
Counties where already promoted	<ul style="list-style-type: none"> • Most counties in the medium to high rainfall areas & arid and semi-arid areas
Counties where TIMP will be up scaled	<ul style="list-style-type: none"> • Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited access and wide distribution of quality cowpea seed (intercrop varieties) • Inadequate access of technical materials on the establishment, operations and management of intercrop management practice by farmers • The increased effects of climate change hindering adoption. • Farmer high poverty levels coupled with illiteracy especially in deep rural areas of Kenya.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Enhance access to quality cowpea seeds across the counties. • Work closely with certified seed merchants, research institutions • Train and sensitize farmers on the basic principles of intercropping, their benefits and types suitable to their contexts. • Use farmer field schools and demonstrations • Develop a comprehensive manual on the practice to guide the farmers during the adoption
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • The practice is very important in pest management. Farmers can use a trap crop to attract pests, keeping them away from the main crop. Therefore, farmers can easily adopt this method to significantly cut down on pesticides input costs • The number of ecological benefits provided by this practice can also accelerate upscaling. Intercropping promotes interactions between crops and pollinators, thus supporting biodiversity and wildlife species.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Socially accepted by both male and female gender. • The practice is environmentally friendly as it enhances biodiversity, controls erosion and minimizes use of pesticides
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 4000
Estimated returns	KES 3000
Gender issues and concerns in development, dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women and youth have limited access to land resource and credit than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Intercropping offers good opportunities to both men and women to grow diverse crops for economic gains and at the same time offers enhanced biodiversity benefits
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed

	<ul style="list-style-type: none"> • 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
VMG related opportunities	<ul style="list-style-type: none"> • Intercropping places emphasis on the importance of using available land space to grow diverse of food crops, increase biodiversity, pest management thus the practice is economically viable for the VMGs • Increased availability of different food products at household level increases food and nutritional security
E: Case studies/profiles of success stories	
Success stories	Undocumented.
Application guidelines for users	<ul style="list-style-type: none"> • Cowpea production guidelines • Journal papers- East African Journal (Agroforestry and Agriculture) • Conference Proceedings- Dryland Farming Systems.
F: Status of TIMP readiness (Ready for upscaling: Requires validation; Requires further research)	
Requires further research	
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO, P. Ketiem, E. Mutuma, M. Okoti, , D. Kamau, A.O. Esilaba
Partner organizations	County governments, KCEP-CRAL project, Universities, CGIAR Organizations

Research gaps

1. Inadequate information on intercropping performances in specific areas of Kenya. For example, there hasn't been much research on optimal levels of fertilizer use for intercropping potatoes and legumes in some areas – the need for site specific validation.
2. Little information on the interactions of various crop intercrops especially in the arid and semi-arid areas (ASALs).
3. Limited knowledge on resource-use efficiency particularly in regions with impoverished soils (ASALs) and economies where measured benefits is greatest.

2.7 COWPEA CROP HEALTH

2.7.1 Integrated Management of Bean Stem maggots on Cowpea


TIMP Name	Integrated Management of Stem maggots on Cowpea
Category (i.e., technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Crop loss due to infestation by bean stem maggots
What is it? (TIMP description)	Integrated management of stem maggots is the use of a combination of various pest approaches in management of the in the in the field, at pre-harvest and at postharvest stages. These approaches include: cultural management, mechanical approaches and chemical control.

Justification	The bean maggot of cowpea can reduce yield in warm areas where infestations are high. Planting a susceptible variety leads to high losses hence need to include cultural methods of manure/ fertilizer and use of a systemic insecticide at early stage to reduce infestation and damage.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trials, demonstrations and farmer field schools • Training workshops, Seminars, Meetings • Field days • Agricultural shows • MoA/Extension officers • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, fact sheets, and manuals) • Web material's • Digital platforms • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test, validate and release improved cowpea varieties with superior yields and quality • A platform for interaction for all cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing

Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the pest and diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPB, KBS to ensure pest control products sold to farmers are genuine and of high quality • The producers are willing to adopt the integrated pest and disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES.1,000 per acre for labour and pesticides cost, which comprises approximately 7% of total variable costs, but could be higher based on the level of pest infestation
Estimated returns	<ul style="list-style-type: none"> • Adequate and timely control of pests, coupled with other management practices contributes towards increased income of between KES. 5,625 and KES. 41,000 from grain production and KES. 210,000 and 260,000 from vegetable production, depending on the variety of certified seed grown.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the pest integrated management practices such as spraying because they are not friendly to them • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the pest integrated management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled

VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> • Farmers in Muranga, Kirinyanga, Embu and Meru have adopted the management practice.
Application guidelines for users	Reference: Plantwise Knowledge Bank Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for up scaling
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma R., Otipa M.J., Wasike, V.W., Mwaura S., Too A., Gathambiri C.
Partner organizations	ICRAF, CABI, KOPPERT, Real IPM

2.7.2 Integrated management of Blister beetle on cowpea flowers

TIMP Name	Integrated management of Blister beetle in cowpea flowers
Category (i.e., technology, innovation or management practice)	<p>Management practice</p>  <p><i>Photo: plantwise.org</i></p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Crop loss due to infestation by Blister beetle.

What is it? (TIMP description)	<p>Integrated management of blister beetle is the application of a combination of various approaches in management which include: cultural, biological, mechanical and chemical control options</p> <p>Cultural practices: these are sustainable options that are aimed at reducing crop pest infestation employing environmentally friendly techniques</p> <p>Biological Control: This involves the use of live organisms to control a pest</p> <p>Chemical management: Involves the use of natural or synthetic chemical sprays</p>
Justification	As flower beetles cause damage on young crop buds and flowers thus reducing podding with consequent loss of yields. Integrated management of the beetles is the most effective and environmentally friendly way to manage the pest and is thus a more sustainable management option for the pest.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • MoA/Extension officers • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web material's • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test, validate and release improved cowpea varieties tolerant to fruit fly infestation • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in fruit fly management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of pest control products for pest and disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,

Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure fungicides sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES.1,000 per acre for labour and pesticides cost, which comprises approximately 7% of total variable costs, but could be higher based on the level of pest infestation
Estimated returns	<ul style="list-style-type: none"> • Adequate and timely control of pests, coupled with other management practices contributes towards increased income of between KES. 5,625 and KES. 41,000 from grain production and KES. 210,000 and 260,000 from vegetable production, depending on the variety of certified seed grown.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the pest integrated management practices such as spraying due to their vulnerability to health hazard. • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals

	<ul style="list-style-type: none"> • Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the pest integrated management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> • Farmers in Muranga, Kirinyanga, Embu and Meru have adopted the management practice.
Application guidelines for users	Reference: Plantwise Knowledge Bank Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for up scaling
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma R., Otipa M.J., Wasike, V.W., Mwaura S., Too A., Gathambiri C.
Partner organizations	ICRAF, CABI, KOPPERT, Real IPM

2.7.3 Integrated Management of African Bollworm, *Helicoverpa spp.* in Cowpea

TIMP Name	Integrated Management of African Bollworm, <i>Helicoverpa spp.</i> in Cowpea
Category (i.e. technology, innovation or management practice)	Management practice


	 <p>Photo: grdc.com.au</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Crop loss due to infestation by bollworm. Low productivity and poor quality of plants due to bollworm attack on cowpea. The damage by the bollworm can lead to 40-80% yield reduction.
What is it? (TIMP description)	Integrated management of bollworm is the employment pest management for sustainable management of the pest. These include: cultural management, tolerant varieties and chemical control.
Justification	Bollworm pest is a nuisance pest that can cause crop damage resulting in reduced yield. Various management options have been used interchangeably to control them. IPM however, is the most effective and sustainable approach to manage the pest.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma,

promoted if any	Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPB, KBS to ensure pest control products sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES.1,000 per acre for labour and pesticides cost, which comprises approximately 7% of total variable costs, but could be higher based on the level of pest infestation
Estimated returns	<ul style="list-style-type: none"> • Adequate and timely control of pests, coupled with other management practices contributes towards increased income of between KES. 5,625 and KES. 41,000 from grain production and KES. 210,000 and 260,000 from vegetable production, depending on the variety of certified seed grown.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the pest integrated management practices such as spraying because they are not friendly to them • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men

Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the pest integrated management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> • Farmers in Muranga, Kirinyanga, Embu and Meru have adopted the management practice.
Application guidelines for users	<ul style="list-style-type: none"> • Plantwise Knowledge Bank Kuruma, R.W. <i>et al.</i> (2021). • KCEP-CRAL Cowpea 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)	Ready for up scaling
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma. R., Otipa M.J., Wasike, V.W., Mwaura S., Too A., Gathambiri C.
Partner organizations	ICRAF, CABI, KOPPERT, Real IPM

2.7.4 Integrated management of Thrips, *Frankliniella* spp) in Cowpea

TIMP Name	Integrated management of Thrips, <i>Frankliniella</i> spp) in Cowpea
Category (i.e. technology, innovation or management practice)	Management practice


	 <p><i>A thrip on leaf tissue (M.Kasina)</i></p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Crop loss due to infestation by thrips
What is it? (TIMP description)	Integrated management of thrips is the application of various pest management approaches for the control of thrips during pre-harvest and postharvest stages. These include: cultural management, biological and chemical control.
Justification	Some unquantified yield loss of cowpea fruits is being experience in the production regions due to attack by thrips. Management of thrips reduces plant stress during dry spell and prevents reduction of photosynthetic rate on plants. Yield potential of the cowpea tree is restored after preventing damage by various thrips species. The most effective control method is the application of IPM.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for pest and disease management

	<ul style="list-style-type: none"> • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure fungicides sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES.1,000 per acre for labour and pesticides cost, which comprises approximately 7% of total variable costs, but could be higher based on the level of pest infestation
Estimated returns	<ul style="list-style-type: none"> • Adequate and timely control of pests, coupled with other management practices contributes towards increased income of between KES. 5,625 and KES. 41,000 from grain production and KES. 210,000 and 260,000 from vegetable production, depending on the variety of certified seed grown.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the pest integrated management practices such as spraying because they are not friendly to them • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men

	<ul style="list-style-type: none"> • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the pest integrated management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> • Farmers in Muranga, Kirinyanga, Embu and Meru have adopted the management practice.
Application guidelines for users	<ul style="list-style-type: none"> • Plantwise Knowledge Bank • Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for up scaling
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma R., Otupa M.J., Wasike, V.W., Mwaura S., Too A., Gathambiri C.
Partner organizations	ICRAF, CABI, KOPPERT, Real IPM

2.7.5 Integrated management of Cutworms in Cowpea

TIMP Name	Integrated management of Cutworms in Cowpea
Category (i.e. technology, innovation)	Management practice


or management practice)	
A: Description of the technology, innovation or management practice	
Problem to be addressed	Crop loss due to infestation by cutworms
What is it? (TIMP description)	This is the use of a combination of various cutworm control/management approaches in pre-harvest and postharvest stages for control of the pest. These approaches include: cultural management, tolerant varieties and chemical control.
Justification	A good crop establishment could predict good yield of cowpea crop. Cutworms could lower yield, but there is need to incorporate different IPM strategies to manage the cutworms at crop establishment. The IPM of cutworms is the most effective control method for management of the pest
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators

C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPB, KBS to ensure fungicides sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 2,500 /ha for labour and fungicides cost
Estimated returns	<ul style="list-style-type: none"> • Gross margin KES 272,610 per ha per season in 8th year
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the pest integrated management practices such as spraying due to their susceptibility to health hazards. • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the pest integrated management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> • Farmers in Muranga, Kirinyanga, Embu and Meru have adopted the management practice.
Application guidelines for users	<ul style="list-style-type: none"> • Plantwise Knowledge Bank • Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for up scaling
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma R., Otipa M.J., Wasike, V.W., Mwaura S., Too A., Gathambiri C.
Partner organizations	ICRAF, CABI, KOPPERT, Real IPM

2.7.6 Integrated Pest Management of Aphids in Cowpea

TIMP Name	Integrated Pest Management of Aphids in Cowpea
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Category (i.e. technology, innovation or management practice)	<p>Management practice</p>  <p>Colony infested cowpea leaf. Aphids, like <i>Aphis fabae</i> photo:</p> <p>greenlife.co.ke Photo source; Too A. KALRO</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Crop loss due to infestation by Aphids
What is it? (TIMP description)	<ul style="list-style-type: none"> It is the application of a combination of pest control practices for effective control of aphids. This involves selection of most effective environmentally safe insecticides and cultural practices.
Justification	<p>Cowpea aphid species have increased across the country preventing potential yield of cowpea. The use of different insecticides both biological and soft-chemical have ensured no resurgence of aphid populations in most farms and also ensures that aphid populations are kept below economic injury levels. Like most other pests' aphids have natural enemies such as lady beetle larva, wasps, spiders and parasitic fungi. Therefore, improving diversity, by planting wild flower strips in the farm and hedge rows, will enhance the beneficial insects. By wrapping a smooth, slippery plastic band around the trunk or any sticky substance will also restrict the movement of the mobile pests. In case of heavy infestation, it is possible to control by spraying a 1 % soap solution with 1 % pure alcohol, with an application of paraffin oil (white oil) as a 3 % water emulsion or with a plant extract of neem or other botanicals. Application of a combination of these control measures is the most effective and sustainable approach to managing aphids.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in	<ul style="list-style-type: none"> On farm and on station research trails and demonstrations

dissemination	<ul style="list-style-type: none"> • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in integrated pest and disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of crop health products for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides for guaranteed food safety • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCBPB, KBS to ensure fungicides sold to farmers are genuine and of high quality

conditions necessary for development and up scaling	<ul style="list-style-type: none"> Producers willing to adopt the disease management practices Producers are organized in groups to ensure that management practices are effectively up-scaled Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> KES 2,500 /ha for labour and fungicides cost
Estimated returns	<ul style="list-style-type: none"> Gross margin KES 272,610 per ha per season in 8th year
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Pregnant and breastfeeding mothers can not apply some of the pest integrated management practices such as spraying because they are not friendly to them Women and youth have limited access to land for Cowpeas cultivation than men Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men Women and youth may have less access to labour than men 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> Employment opportunities for youth as service providers e.g. in spraying with chemicals Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men VMGs have less access to information, technology and knowledge than men VMGs may have less access to labour than men Some of the pest integrated management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> Employment opportunities for youth and those recovering from drugs as service providers especially during spraying Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Muranga, Kirinyanga, Embu and Meru have adopted the management practice.
Application guidelines for users	Reference: Plantwise Knowledge Bank
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up scaling
G. Contacts	

Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma R., Otipa M.J., Wasike, V.W., Mwaura S., Too A., Gathambiri C.
Partner organizations	ICRAF, CABI, KOPPERT, Real IPM

2.7.7 Integrated Management of Maruca pod borer on Cowpea


TIMP Name	Integrated Management of Maruca pod borer on Cowpea
Category (i.e. technology, innovation or management practice)	<p>Management practice</p>  <p>Phot</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Crop loss due to infestation by maruca pod borer. The damage by the maruca pod borer can lead to 40-80% yield reduction.
What is it? (TIMP description)	This is s the use of a combination of various pest control approaches that include: cultural, biological and chemical control.
Justification	Maruca pod borer is a nuisance pest that can cause crop damage resulting into reduced yield. It can cause dry cowpea flower abortion and pod damage. To manage the damage, it is important to plan early with IPM management options. Inyegrated management opotions include planting tolerant varieties or intercropping with repellent plant types reduce significantly the damage level.

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • MoA/Extension officers • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform

	<ul style="list-style-type: none"> 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 up scaling	<ul style="list-style-type: none"> Regulatory bodies e.g. PCPB, KBS to ensure pest control products sold to farmers are genuine and of high quality Producers willing to adopt the disease management practices Producers are organized in groups to ensure that management practices are effectively up-scaled Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> KES 2,500 /ha for labour and fungicides cost
Estimated returns	<ul style="list-style-type: none"> Gross margin KES 272,610 per ha per season in 8th year
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Pregnant and breastfeeding mothers can not apply some of the pest integrated management practices such as spraying because they are most vulnerable Women and youth have limited access to land for Cowpeas cultivation than men Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men Women and youth may have less access to labour than men 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> Employment opportunities for youth as service providers e.g. in spraying with chemicals Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men VMGs have less access to information, technology and knowledge than men VMGs may have less access to labour than men Some of the pest integrated management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> Employment opportunities for youth and those recovering from drugs as service providers especially during spraying Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Muranga, Kirinyanga, Embu and Meru have adopted the management practice.
Application guidelines for users	<ul style="list-style-type: none"> Plantwise Knowledge Bank <p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p>
F: Status of TIMP	Ready for up scaling

readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research)	
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma R., Otipa M.J., Wasike, V.W., Mwaura S., Too A., Gathambiri C.
Partner organizations	ICRAF, CABI, KOPPERT, Real IPM

2.7.8. Integrated disease management (IDM) of Rust in Cowpea



TIMP Name	Integrated disease management (IDM) of Rust in Cowpea
Category (i.e. technology, innovation or management practice)	<p>Management practice</p>  <p>(Picture source; Ruth Amata, KALRO)</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Yield loss and low grain quality due to rust disease
What is it? (TIMP description)	This is the application of a combination of various approaches for the control of the rust in cowpea. These approaches include: cultural management, biological and chemical control.
Justification	Rust is a major challenge in cowpea production in Kenya, occurring in all major production areas. The disease is severe because the pathogen produces abundant spores which are airborne, spread easily through air and splash and cover leaves reducing the plants photosynthetic area. The earlier the infection, the more severe the disease which causes leaf fall. Significant losses of up to 35% have been reported due to rust disease in cowpea. Integrated Disease Management is an environmental friendly approach to disease control which enables the use of various strategies to alleviate yield loss due to diseases.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> On farm and on station research trails and demonstrations Training workshops, Seminars, Meetings

	<ul style="list-style-type: none"> • Field days • Agricultural shows • MoA/Extension officers • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web material's • Mobile • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCBPB, KBS to ensure fungicides sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices

conditions necessary for development and up scaling	<ul style="list-style-type: none"> Producers are organized in groups to ensure that management practices are effectively up-scaled Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> KES 2,500 /ha for labour and fungicides cost
Estimated returns	<ul style="list-style-type: none"> Gross margin KES 272,610 per ha per season in 8th year
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Pregnant and breastfeeding mothers can not apply some of the integrated management disease practices such as spraying because they are the most vulnerable Women and youth have limited access to land for Cowpeas cultivation than men Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men Women and youth may have less access to labour than men 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> Employment opportunities for youth as service providers e.g. in spraying with chemicals Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men VMGs have less access to information, technology and knowledge than men VMGs may have less access to labour than men Some of the integrated disease management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> Employment opportunities for youth and those recovering from drugs as service providers especially during spraying Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Murang'a, Nyeri, Kiambu, Kisii, Meru. have adopted the management practice.
Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for up scaling

G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma R., Otipa M.J., Amata R., Mutisya D. and Too Abel
Partner organizations	ICRISAT,

2.7.9. Integrated disease management (IPM) of Anthracnose (*Collectotrichum spp*) in Cowpea



TIMP Name	Integrated disease management (IPM) of Anthracnose (<i>Collectotrichum spp</i>) on Cowpea
Category (i.e. technology, innovation or management practice)	<p>Management practice</p> <div style="display: flex; justify-content: space-around;">   </div> <p style="text-align: center;">Anthracnose on pods and leaves (Source: Ruth Amata, KALRO)</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Yield loss and low grain quality due to anthracnose disease
What is it? (TIMP description)	Integrated anthracnose disease management is the use of a combination of various approaches. They are applied during pre-harvest stages. These approaches include: cultural management, deployment of tolerant varieties and chemical control.
Justification	Anthracnose disease is a major challenge in bean production in Kenya, occurring in all major production areas. The disease is severe during cool wet conditions. It causes significant yield loss both in terms of quantity and quality. It is a seed-borne disease and therefore very common in areas where farmers recycle their own saved seed. It is a quarantine disease which leads to rejection where farmers are growing seed bean. It also causes up to 60% postharvest losses leading to reduced returns for the farmers and negatively impacts on food and national security of the country. IDM provides a sustainable management option for control of the disease.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days

	<ul style="list-style-type: none"> • Agricultural shows • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCBPB, KBS to ensure fungicides sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 2,500 /ha for labour and fungicides cost
Estimated returns	<ul style="list-style-type: none"> • Gross margin KES 272,610 per ha per season in 8th year
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the integrated disease management practices such since they are most vulnerable • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the integrated disease management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Murang'a, Nyeri, Kiambu, Kisii, Meru have adopted the management practice.
Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for up scaling
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org

	Phone: 0727624471
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Partner organizations	ICRISAT,

2.7.10. Integrated management of Powdery Mildew (*Oidium polygoni*)



TIMP Name	Integrated management of Powdery Mildew (<i>Oidium polygoni</i>)
Category (i.e. technology, innovation or management practice)	<p>Management practice</p> <div style="display: flex; justify-content: space-around;">   </div> <p>Photo by: Plantdoctor.co.nz</p> <p style="text-align: right;">Powdery mildew (<i>Erysiphe polygoni</i>)</p> <p style="text-align: right;">(Source; Sila Nzioki KALRO)</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Yield losses occasioned by powdery infection
What is it? (TIMP description)	This the deployment of a combination to break the disease cycle. These approaches include: cultural management and chemical control.
Justification	Powdery mildew is a major challenge in cowpea production found in all major production areas. The disease attacks the leaves and flowers but is most destructive on the leaves causing drying up and abortion of flowers. The disease is severe because the pathogen produces abundant spores which cover leaves reducing the plants photosynthetic area. This causes significant yield loss of up to 30-35%. Under severe infection, it causes leaf fall. Integrated Disease Management is an environmental friendly approach to disease control which enables the alleviation of yield loss due to disease damage.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • MoA/Extension officers • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals)

	<ul style="list-style-type: none"> • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Dissemination of integrated disease management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • 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 • Adoption of good agricultural practices by the producers is key in management of the diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure fungicides sold to farmers are genuine and of high quality. • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 2,500/ha for labour and fungicide in 9 th year

Estimated returns	Gross margin KES 272,610 per ha per season in 8 th year
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the integrated management practices such as spraying since they are most vulnerable • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the integrated disease management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Murang'a and Embu and Makueni have adopted the management practice.
Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for up scaling
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471

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Partner organizations	ICRAF, CABI



2.7.11. Integrated Management of halo blight and bacterial leaf blight disease in Cowpea

TIMP Name	Integrated Management of halo blight and bacterial leaf blight disease in Cowpea
Category (i.e. technology, innovation or management practice)	<p>Management practice</p>  <p>Halo blight disease of cowpea (Source; Ruth Amata, KALRO)</p>  <p>Bacterial leaf blight of cowpea (Source; Sila Nzioki KALRO)</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Yield losses due to infection bacterial leaf blight and halo blight disease
What is it? (TIMP description)	Integrated disease management is the use of a combination of cultural management practices, deployment of tolerant varieties and chemical control in the management of halo blight and bacterial blight disease in cowpea.
Justification	Cowpea halo blight disease is a serious seed borne disease in cowpea production in Kenya, occurring in all major production areas, but being more severe in some regions. IDM presents a more effective and sustainable disease management option
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks

	<ul style="list-style-type: none"> • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved Cowpea varieties • A platform for interaction of Cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Cowpea innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides • Promote establishment of farmer producer and marketing groups
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Adoption of good agricultural practices by the producers is key in management of the diseases
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g., PCBPB, KBS to ensure fungicides genuine and high-quality pesticides are available. • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 2,500/ha for labour and fungicides in 9 th year
Estimated returns	Gross margin KES 272,610 per ha per season in 8 th year
Gender issues and concerns in development	<ul style="list-style-type: none"> • Due to them being most vulnerable, pregnant and breastfeeding mothers can not apply some of the integrated disease management practices such as spraying

,dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the integrated disease management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Muranga and Embu and Makueni have adopted the management practice.
Application guidelines for users	Reference: CAB International (2005). Crop Protection Compendium, 2005 edition. Wallingford, UK www.cabi.org
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up scaling
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma R., Otipa, M. J., Amata R., Mutisya D. Finyange P Finyange and Too A.
Partner organizations	ICRAF, CABI


2.7.12. Integrated management of Leaf spots on Cowpea

TIMP Name	Integrated management of Leaf spots in Cowpea
Category (i.e. technology, innovation or management practice)	<p>Management practice</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p style="text-align: right;">Cercospora leaf spot disease (<i>Cercospora</i> sp.) (Source; Ruth Amata KALRO)</p> <p>Angular leaf spot disease (<i>Phaeoisariopsis griseola</i>, sp.) (Source; Ruth Amata KALRO)</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Yield losses occasioned by leaf spot disease infections in cowpea.
What is it? (TIMP description)	This is the application of a combination of two or more disease control approaches for the control of the cowpea leaf spot diseases. These approaches include: cultural management and chemical control.
Justification	The leaf spots reduce photosynthetic capacity of the crop, leaf fall, dieback of plants, or distortion of leaves therefore, causing reduced farmer returns. Integrated leafspot management is a strategy that provides the most effective and sustainable option of disease control.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained

roles	<ul style="list-style-type: none"> • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides • Dissemination of agronomic practices
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Adoption of good agricultural practices by the producers is key in management of the diseases
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCBPB, KBS to ensure fungicides sold to farmers are genuine and of high quality. • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 2,500/ha in 8 th year
Estimated returns	Gross margin KES 272,610 per ha per season
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the disease integrated management practices such as spraying as they are most vulnerable to chemical health hazards. • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro

	chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the integrated disease management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Machakos, Makueni have adopted the management practice.
Application guidelines for users	<p>CABI Crop Protection Compendium. (2010). <i>Persea americana</i> datasheet. Available at: http://www.cabi.org/cpc/datasheet/39380.</p> <p>CABI Plantwise Knowledge Bank</p> <p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p>
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up scaling
G. Contacts	
Contacts	<p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p>
Lead organization and scientists	KALRO Otipa, M. J., Amata R., Mutisya D. Finyange P Finyange and Too A.
Partner organizations	ICRAF, CABI


2.7.13. Integrated Management of root rot and Fusarium wilt diseases on Cowpea

2.1.1.1 Integrated Management of Root Rot and Fusarium wilt diseases in Cowpea		
TIMP Name	Integrated Management of root rot and Fusarium wilt diseases in Cowpea	
Category (i.e. technology, innovation or management practice)	Management practice <div></div> <p>Dry Root rot (<i>Fusarium solani</i> fsp. <i>phaseoli</i>.) (Source; vegetablemdonline.ppath.cornell.edu)</p>	
A: Description of the technology, innovation or management practice		
Problem to be addressed	Yield loss and low grain quality of cowpea due to <i>fusarium</i> wilt disease.	
What is it? (TIMP description)	This is the application of a combination of two or more disease control approaches for the control of the fusarium wilt disease of cowpea. . These are applied during pre-harvest stages and include: cultural management, deployment of tolerant varieties and chemical control.	
Justification	Fusarium disease is a major challenge in cowpea production in Kenya, occurring in all major production areas. The disease is severe during cool wet conditions. It causes significant yield loss both in terms of quantity and quality. It is a seed-borne disease and therefore very common in areas where farmers recycle their own saved seed. It also causes up to 60% postharvest losses leading to reduced returns for the farmers and negatively impacts on food and national security of the country. Integrated Fusarium wilt management is a strategy that provides the most effective and sustainable option of disease control.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	<ul style="list-style-type: none">• Producers, exporters	
Approaches used in dissemination	<ul style="list-style-type: none">• On farm and on station research trails and demonstrations• Training workshops, Seminars, Meetings• Field days• Agricultural shows• Farmer research networks• Farmer to farmer extension	

	<ul style="list-style-type: none"> • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCBPB, KBS to ensure fungicides sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 2,500 /ha for labour and fungicides cost
Estimated returns	<ul style="list-style-type: none"> • Gross margin KES 272,610 per ha per season in 8th year
Gender issues and	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the

concerns in development, dissemination, adoption and scaling up	<p>disease management practices such as spraying due to their vulnerability to chemical hazard</p> <ul style="list-style-type: none"> • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the integrated disease management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Murang'a, Nyeri, Kiambu, Kisii, Meru. have adopted the management practice.
Application guidelines for users	Reference: K. S Kimaru, K. P Muchemi & J. W Mwangi Manuel Tejada Moral (Reviewing editor) (2020) Effects of anthracnose disease on cowpea production in Kenya, Cogent Food & Agriculture, 6:1, DOI: 10.1080/23311932.2020.1799531
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up scaling
G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Otipa M.J., Amata R., Mutisya D. and Too Abel
Partner organizations	ICRISAT,

2.7.14. Integrated Management of Cowpea Mosaic Virus on Cowpea


TIMP Name	Integrated Management of Cowpea Mosaic Virus on Cowpea
Category (i.e. technology, innovation or management practice)	Management practice  <p>Yellow and Cowpea Mosaic Virus disease</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Yield loss and low grain quality due to Cowpea Mosaic virus diseases
What is it? (TIMP description)	<p>Cowpea severe mosaic virus (CMV), is a disease that causes crinkling and severe mottling of newly emerging leaves and, in severe cases, results in the overall stunting of the plant. CMV is transmitted by white flies and aphids. Other field symptoms usually consist of discoloration of the leaves, showing mosaic, mottling, vein banding, vein chlorosis, vein yellowing, leaf deformation and yellow spots.</p> <p>Integrated Disease Management package for Cowpea Mosaic virus disease involves use cultural, biological and chemical control options.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Start off with certified seed/disease free seed • Ensure that sanitation and field hygiene practices are adhered to by collecting and disposing infected leaves. • Ensure that pruning is undertaken to remove diseased plants and also improve on air circulation. • Avoid excessive watering when irrigating or surface run off as it spreads the pathogen to non-infected areas • Ensure that the farm is weeded and other agronomic practices are carried out • Use tolerant varieties: Recently released varieties will be validated for their relative tolerance/resistance to <i>fusarium</i> wilt/rot disease. • Practice crop rotation with non-legumes for 6-8 seasons (3-4 years) since the virus is able to last long in the soil • Uproot affected plants and burn to reduce inoculum, • Disinfect farm tools in jik solution (50ml: litre) to prevent spread of the disease

	<p>Biological Control</p> <ul style="list-style-type: none"> • Use of bio-pesticides such as Botanigard ES, Biocatch 1.15WP, Nimbecidine EC, Achook 0.15% EC and Neemraj Super 3000. • The use of yellow sticky traps and Female pheromone traps have also been validated as effective methods for the control of aphids and whiteflies. • Use of Trichoderma based biological control agents e.g rootgard and validating products including, Eco-T, Trianum P 11.5WP and Trichotech, Rootgard and Biocure F at planting. Validation of (Trianum P, Trichotech, Rootgard) biopesticides will be done <p>Chemical management:</p> <ul style="list-style-type: none"> • Use soft/relatively safe synthetic pesticides such as Calypso SC 480, Closer 240SC and Eabcl Contest 5.7 WDG to control the vectors. Use of soft/safe synthetic pesticides will only be recommended registered as a last option.
Justification	<p>Viral diseases are a major challenge in cowpea production in Kenya, occurring in all major production areas. The disease is severe during cool wet conditions. The disease is vectored by both aphids and whiteflies. This implies that the control of the viral disease is pegged on the control of aphids and whiteflies. They cause significant yield losses because they disable the ability of the plants to photosynthesize. It causes significant yield loss both in terms of quantity and quality. It also causes up to 30-60% postharvest losses leading to reduced returns for the farmers and negatively impacts on food and national security of the country.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • MoA/Extension officers • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained

	<ul style="list-style-type: none"> • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCBPB, KBS to ensure fungicides sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 2,500 /ha for labour and fungicides cost
Estimated returns	<ul style="list-style-type: none"> • Gross margin KES 272,610 per ha per season in 8th year
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the disease integrated management practices such as spraying because they are not friendly to them • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as chemicals used in spraying than men • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men

Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers • Affirmative action in various areas as for instance in the provision of finances for farming
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the integrated disease management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Affirmative action in various areas as for instance in the provision of finances for farming to VMGs • Use of the farmer field and business school strategy for effective training of VMG s on cowpea production and management • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Murang'a, Nyeri, Kiambu, Kisii, Meru. have adopted the management practice.
Application guidelines for users	<p>Reference: K. S Kimaru, K. P Muchemi & J. W Mwangi Manuel Tejada Moral (Reviewing editor) (2020) Effects of anthracnose disease on cowpea production in Kenya, Cogent Food & Agriculture, 6:1, DOI: 10.1080/23311932.2020.1799531</p> <p>Kuruma, R.W., .et al. (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p>
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Ready for up scaling
G. Contacts	
Contacts	<p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p>
Lead organization and scientists	<p>KALRO Kuruma R., Otipa M.J., Amata R., Mutisya D. and Too Abel</p>
Partner organizations	ICRISAT,

2.7.15. Integrated Management of Root Knot Nematodes on Cowpea





TIMP Name	Integrated Management of Root knot Nematodes on Cowpea
Category (i.e. technology, innovation or management practice)	<p>Management practice</p>  <p>Root knot nematode (<i>Meloidogyne</i> spp.) (Source; Miriam Otipa, KALRO)</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Yield loss and low grain quality due to infestation by root knot nematodes
What is it? (TIMP description)	The root rot nematode is an endoparasite that causes significant yield losses. The nematode attacks many major food crops resulting in reduction in quality and quantity of food. Yield loss ranges from 5%- to complete total loss of cowpea production. The nematode affects the flowering, podding, seedling and vegetative growing stages.
Justification	Root knot nematodes are a major challenge in a wide range of crops including cowpea. The pest occurs in all soil types. It is most severe where host crops are planted season after season. Failure to observe crop rotation with grass crops which are poor hosts would lead to higher severity cases. This must be combined with the use of other control measures including solarisation, cultural practises that enhance field hygiene and biopesticides.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • MoA/Extension officers • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms • Farmer field and business schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive research to test validate and release improved cowpea varieties • A platform for interaction of cowpea value chain stakeholders • Adoption of appropriate agronomic practices • Well organized farmer groups and networks

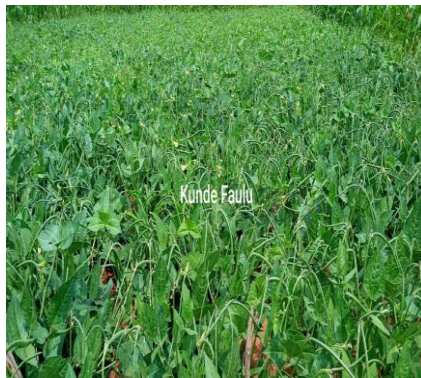

Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness of the disease. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Muranga, Kiambu, Nyeri, Embu, Meru, Uasin Gishu, Nakuru, Bungoma, Trans Nzoia, Nandi, Narok, Bomet, Machakos, Makweni, Kisii, Siaya, Busia,
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Limited number of farmer groups • Lack of cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish cowpea innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • 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 up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCBPB, KBS to ensure fungicides sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 2,500 /ha for labour and fungicides cost
Estimated returns	<ul style="list-style-type: none"> • Gross margin KES 272,610 per ha per season in 8th year
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Pregnant and breastfeeding mothers can not apply some of the pest integrated management practices such as spraying due to their susceptibility to chemical health hazards • Women and youth have limited access to land for Cowpeas cultivation than men • Women and youth may also have limited access to finances to buy

	<p>the required inputs such as chemicals used in spraying than men</p> <ul style="list-style-type: none"> • Women and youth may have less access to labour than men • 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 less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youth as service providers e.g. in spraying with chemicals • Potential to create employment along the value chain e.g. agro chemical dealers • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production • Financial institutions to provide credit facilitators • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited resources to purchase the required inputs such as the chemicals used in spraying than men • VMGs have less access to information, technology and knowledge than men • VMGs may have less access to labour than men • Some of the integrated pest management practices such as, spraying are difficult to undertake by some VMGs such as the elderly and the disabled
VMG related opportunities	<ul style="list-style-type: none"> • Financial institutions to provide credit facilitators • Use of the farmer field and business school strategy for effective training of farmer groups on cowpea production • Employment opportunities for youth and those recovering from drugs as service providers especially during spraying • Potential to create employment along the value chain e.g. agro chemical dealers • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers in Murang'a, Nyeri, Kiambu, Kisii, Meru. have adopted the management practice.
Application guidelines for users	<p>Reference: K. S Kimaru, K. P Muchemi & J. W Mwangi Manuel Tejada Moral (Reviewing editor) (2020) Effects of anthracnose disease on cowpea production in Kenya, Cogent Food & Agriculture, 6:1, DOI: 10.1080/23311932.2020.1799531</p>
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up scaling

G. Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO Kuruma R., Otipa M.J., Amata R., Mutisya D. and Too Abel
Partner organizations	ICRISAT,

2.7.16. Cowpea (*Vigna unguiculata*) Integrated Weed Management

TIMP Name	Cowpea Integrated Weed Management	
Crop management practices	Management	
A: Description of the technology, innovation or management practice		
Problem addressed	Poor weed management practices of different annual and perennial weed species that lead to yield losses and lack of profitability in cowpea cropping systems.	
		
	<i>Gallant soldier (Galinsoga parviflora)</i> <i>Source: Hottensiah Mwangi</i>	<i>Black jack (Bidens pilosa)</i> <i>Source: Violet Momanyi</i>
		
	<i>Weed free Cowpea crop</i> <i>Source: KALRO.</i>	<i>Cowpea growing in weeds</i> <i>Source: Hottensiah Mwangi</i>
What is it? (TIMP description)	Integrated Weed Management (IWM) is timely management of weeds using two or more appropriate approaches including	


	preventive, use of mulch (biodegradable or synthetic), cultural, rotation, intercropping and chemical control. Proper identification of species determines the management practice because one approach will be effective on some species and not others.	
		
	Weed free mature Cowpea crops. Source: Rose Wangari Kuruma	
Justification	Weed control is essential for maintaining high levels of crop production. The weeds impact yields negatively primarily by competing with the crop for light, water and nutrients. Other than affecting crop production weeds act as reservoirs of various viruses that are transmitted by insects. Several insects transmit different viruses in different crops, but aphids and whiteflies are among the most important virus <i>vectors</i> . The insect vectors feed on various parts of weeds that are infected by a virus and feed on uninfected agricultural crops and transmit the virus to them.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Farmers, Extension workers, scientists	
Approaches used in dissemination	<ul style="list-style-type: none">• Farmer field and business Schools (FFBS)• Agricultural Innovation Platforms (AIP)• Training workshops• Seminars and Meetings• Demonstrations and field days.• Digital platform• Manuals, pamphlets/ leaflets.	
Critical/ essential factors for successful promotion	<ul style="list-style-type: none">• Applied and adaptive Research to test validate and release Integrated Weed Management (IWM) practices in Cowpea cropping systems• A platform for interaction of Cowpea value chain stakeholders• Promote and train stakeholders on IWM.• Address environmental and safety concerns related to the use of selected herbicides• Accompany the promotion with demos and field days with	


	<p>farmer groups and stakeholders on the effectiveness of the various weed management options using FFBs approach.</p> <ul style="list-style-type: none"> • Train users on appropriate and safe use of herbicides. • Train stakeholders on biology, dynamics and identification of weeds in order to employ best control method. • Training farmers on timing of weeds and safe use of pesticides in order to preserve pollinators needed for increased crop productivity.
Partners/stakeholders for scaling up and their respective roles.	Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALF&I), Research partners (KALRO, County extension staff, NGOs).
C: Current situation and future scaling up	
Counties where already promoted if any	Not yet promoted
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of proper IWM practices • labour intensive, and high cost labor of weed management • high cost of herbicides • Inadequate knowledge and information on choice of herbicides to use, when to use them and their persistence in the soil. • Myths on risks and appropriateness of using herbicides
Suggestion for addressing the challenges	<ul style="list-style-type: none"> • Establish Cowpea innovation platforms for promotion of IWM in the suitable areas by conducting demos and field days • Develop and disseminate information on proper IWM practices. • Train on integrated approaches using available methods, including appropriate herbicides for weed control in Cowpea. • Their persistence in different soil environment that can affect successive crops in the rotation as a result of residues or carryover. • Train users on safe use of herbicides.
Lesson learned in up scaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • IWM is more effective and environmentally friendly than use of one control method. • Continuous use of herbicides is an environmental and human health risk hence the need for safe and appropriate use. • Use of herbicides where crop rotation is done needs care to avoid persistence of residues in the soil. • Consumer concerns of herbicide residues in the soil and subsequent crops needs attention

	<ul style="list-style-type: none"> • Creation of awareness through demonstrations and farmer field days help in adoption of IWM technology • Partnership through innovation platforms
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Train on understanding and working of IWM. • Address the environmental and social concerns related to use of herbicides. • An approved agrodealer network to supply registered and not fake and expired herbicides to farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About Ksh 20,000/ acre (use basic cost of the technology)
Estimated returns	About 800-4,000 kg/acre. Ksh 64,000 - 320,000/acre
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women perform most of the crop production activities such as weeding hence this may increase their work burden • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in weeding and the youths in spraying
Vulnerable and marginalized groups (VMG) issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seed potato cuttings • 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
Vulnerable and marginalized groups (VMG) related opportunities	<ul style="list-style-type: none"> • Opportunities exist for those recovering from drugs in weeding and spraying
E: Case studies/profiles of success stories	
Success stories	Kenya small holder farmers.
Application guidelines for users	<p><i>Sinchana J.K. and Raj S.K. A review on integrated approach for the management of weeds in Cowpea (Vigna unguiculata). Journal of Applied and Natural Science. 2020: 12(4):504-510.</i></p> <p>https://doi.org/10.31018/jans.v12i4.2386.</p> <p><i>All Answers Ltd. Weed Control, Sustainability, Hazards and Risks in Cowpea Cropping Systems.</i></p> <p>https://ukdiss.com/examples/sweetpotato-cropping-systems-weed-control.</p>
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation.
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI.</p> <p>Tel:+254-0721822312</p>

	E-mail: cd.narl@kalro.org
Lead organization and scientists	KALRO, Mwangi H.W., Momanyi V.N. and Kuruma. R.W
Partner organizations	KALRO, NGOs, CBOs, County Governments, KEPHIS

2.7.17. Cowpea Intercropping System

TIMP Name	Cowpea Intercropping System
Categories (i.e. technology innovation or management practice)	Management
A: Description of the technology, innovation or management practice	
Problem addressed	Poor weed management practices of annual and perennial weeds that compete with the crop for nutrients and other growth factors which leads to yield loss.
What is it? (TIMP description)	Intercropping system is the growing of two or more crops in a field at the same time to reduce weed infestation, enhance production and use the land efficiently. There are several intercropping systems such as mixed, strip, row intercropping patterns, Relay and Alley intercropping. Innovative intercropping systems will involve arrangement that reduces weeds. More complex intercropping systems with more than 2 crops have also been tested.
Justification	<p>Intercrops and straw in middle rows can provide weed control between rows and reduce weed establishment in the field. Intercropping systems help farmers achieve the desired yield gains while at the same time diversifying the cropping system and adapting to climate change. Poor intercropping results in low yields attributed to competition for growth resources, light and nutrients and may lead to increased infestation of pests and diseases. Cowpea does well when intercropped with cereals such as maize and sorghum to mitigate the risk of total crop failure due to drought.</p>  <p style="text-align: center;"><i>Cowpea-maize intercrop</i></p> <p>Intercropping has advantages in regard to efficient land use. It can significantly increase total productivity due to better utilization of water and nutrients as compared to monocropping.</p>

	Crops in this system use available resources more efficiently due to different rooting and canopy properties. It is a risk mitigation strategy by farmers in light of prevailing climate change patterns.
B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers, Extension Staff
Approaches used in dissemination	<ul style="list-style-type: none"> Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Training workshops, Seminars, Meetings Promotional materials (posters/ brochures/ leaflets/ manuals).  <p>Demos and field days Source: Hottensiah Mwangi</p>
Critical/ essential factors for successful promotion	<ul style="list-style-type: none"> Using applied and adaptive Research to test, validate and release intercropping system in Cowpea varieties Creation of a platform for interaction of Cowpea value chain stakeholders Conducting demos and field days with farmer groups and other stakeholders
Partners/ stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> County extension staffs NGOs Private sectors e.g. agrodealers, Research organizations (KALRO, Egerton University, UoN)
C: Current situation and future scaling up	
Counties where already promoted if any	Taraka Nithi. Makueni
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders Low use of intercropping agronomic practice Inadequate training and limited extension staff
Suggestion for addressing the challenges	<ul style="list-style-type: none"> Establish Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders

	<ul style="list-style-type: none"> • Promote the use of intercropping agronomic practice in cowpea production through demonstrations and field days • Facilitate training of county extension staffs
Lesson learned in up scaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Intercropping systems require making adjustments in traditional ways of cropping. Such a change calls for intensive training and demonstration for farmers to familiarize with the innovation and its benefits. • Creation of awareness through demonstrations and farmer field days help in adoption of intercropping of Cowpea. • Availability of market to sell produce is 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 up-scaling	A farmer learning platform is essential for training on how to deploy the innovative intercropping systems.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About Ksh 25,000/ acre
Estimated returns	About 800-4,000 kg/acre. Ksh 64,000 - 320,000/acre
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for water pan than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Intercropping offers good opportunities to both men and women to grow diverse crops for economic gains and at the same time offers enhanced biodiversity benefits • Diversity and yield stability are a major win for women who have to ensure that the family has food and nutritional security
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • 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	<ul style="list-style-type: none"> • Intercropping places emphasis on the importance of using available land space to grow diverse of food crops, increase biodiversity, weed management thus the practice is economically viable for the VMGs • Diversification and yield stability will increase food availability leading to food and nutrition security for the VMGs • Improved income from production and marketing of intercrops systems gives diversified incomes
E: Case studies/profiles of success stories	
Success stories	Taraka Nithi, Makueni
Application guidelines for users	<ul style="list-style-type: none"> • Ennin SA, Asafu-Agyei JN, Dapaah HK and Ekyem SA. Cowpea rotation with maize in cassava-maize intercropping systems. Tropical Agriculture. 2001;78(4):218-225. • Manuals from KALRO and MALF&L
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 Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI. Tel:+254-0721822312 E-mail: cd.narl@kalro.org
Lead organization and scientists	KALRO, Mwangi H.W., Momanyi V.N. and Kuruma. R.W
Partner organizations	Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALF&I), County Extension Staff, Farmer Groups and CBOs, NGOs

2.7.18. Cover cropping for Cowpea weed management

TIMP Name	Cover cropping for Cowpea weed management
Categories (i.e. technology innovation Or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Poor management of different annual and perennial weed species leads to yield losses and lack of profitability in cowpea cropping systems.
What is it? (TIMP description)	Cover cropping is growing of specific selected crops together with the main crop to produce biomass/ canopy that covers the soil. After cover crop has produced biomass, it may later be killed by rolling it down or desiccated with a herbicide to form a soil cover. This cover acts as a physical barrier cutting off

	light to stop germinating weed seeds and stop emerging weeds. Large amounts of the cover crop/ biomass may suppress weeds in a subsequent season depending on the type of cover crop used and amounts of biomass.
Justification	Cover cropping with appropriate cover crop technology works well with Cowpea in no till system. The cover crop develops ground cover/ biomass that suppresses weeds for a month or two (depending on amount of biomass) which reduce weed competition for nutrients, conserves soil moisture which modifies soil temperatures that favour yield increase.
B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers, Extension Staff
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations and farmer field days • Source for availability of market • Partnership in technology dissemination and adoption • Demos and field days
Critical/ essential factors for successful promotion	<ul style="list-style-type: none"> • Formation of farmer field and business Schools (FFBS) • Employ applied and adaptive Research to test, validate and release cover cropping technology in Cowpea varieties • Facilitate partnership in technology dissemination and adoption through innovation platforms • Creation of awareness through demonstrations and farmer field days • A platform for interaction of cowpea value chain stakeholders • Conduct demos and field days to promote cover cropping
Partners/ stakeholders for scaling up and their respective roles.	Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALF&I), County extension staffs, NGOs, Research organizations (KALRO, Egerton University, UoN)
C: Current situation and future scaling up	
Counties where already promoted if any	Not yet promoted
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the the agronomic practice • Labour intensity in planting and weeding • Inadequate training and limited extension staff
Suggestion for addressing the challenges	<ul style="list-style-type: none"> • Establish Cowpea innovation platforms • Dissemination of information promoting the the

	<p>technology in the suitable areas</p> <ul style="list-style-type: none"> • Facilitation of training of county extension staffs
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • 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 cover cropping technology • Availability of market for the produce is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Cover cropping technology requires adjustments in traditional ways of cropping. Such changes call for intensive training and demonstration for farmers to familiarize with the technology and its benefits. • There is need to adapt the technology when promoting in new environments/ AEZ
Social, environmental, policy and market conditions necessary for development and up-scaling	A farmer learning platform is essential for training on how to deploy the technology.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About Ksh 25,000/ acre
Estimated returns	About 800-4,000 kg/acre. Ksh 64,000 - 320,000/acre
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for water pan than men • Women and youths have less access to technology knowledge and information • Women have less access to farm implements
Gender related opportunities	<ul style="list-style-type: none"> • Cover cropping system can result in reduced labour, for women who mostly perform the task of weeding • Opportunities exist for women to perform the operation • Diversity and yield stability are a major win for the various gender categories
Vulnerable and Marginalized Groups (VMG) issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs may have less access to specialized implements required for cover cropping systems • Diversity and yield stability are a major win for the marginalized communities
VMG related opportunities	<ul style="list-style-type: none"> • Cover cropping system can result in reduced labour for the VMGs • System diversification and yield stability will increase food availability leading to food and nutrition security for the VMGs • Improved income from production and marketing of

	Cowpeas and other cover crops
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Mwangi HW, Kihurani AW, Wesonga JM, Ariga ES, & Kanampiu F. Factors influencing adoption of cover crops for weed management in Machakos and Makueni counties of Kenya. <i>European Journal of Agronomy</i>. 2015a;69(2015)1-9. Http://dx.doi.org/10.1016/j.eja.2015.05.001.</p> <p>Mwangi HW, Ngahu J, Kihurani A. Effect of legume cover crops and imazapyr herbicide coated seed on weeds and green maize yield. Proceedings: 2ACAAC – Second Africa Congress on Conservation Agriculture held on 9-12th October 2018 Johannesburg, South Africa.1116-0301 Published by Elsevier B.V.</p> <p>Kuruma, R.W., <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p>
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	2. Requires validation
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI. Tel:+254-0721822312 E-mail: cd.narl@kalro.org</p>
Lead organization and scientists	KALRO, Mwangi H.W., Momanyi V.N. and Kuruma. R.W
Partner organizations	County Extension Staff, Farmer Groups and CBOs, NGOs

2.7.19. Mulching Cowpea

TIMP name	Mulching for Cowpea weed management
Category (i.e. technology/ innovation/ management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Weed competition with cowpea crop for soil moisture and nutrients; and Regulation of soil temperatures which lower yield and quality.
What is it? (TIMP description)	The practice involves covering the soil/ ground with natural biodegradable (eg grass, straw) or synthetic (eg black polythene paper) materials. Mulches can effectively control weeds from seeds that germinate near or at the soil surface, add organic matter to the soil, prevent soil erosion and decrease weed population in initial crop growth stage by reducing the weed seed bank and emergence. They reduce tillage operations, enhance


	crop yield by reducing the soil temperature, increase the soil moisture level, lower the weed density and help improve soil fertility when they decompose.
Justification	Mulching cowpea soon after planting suppresses and minimizes weed infestation which enhances the growth and increases the yield of the crop.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools(FFBS) • Agricultural Innovation Platforms (AIP) • Farmer field Business schools • On-farm demonstrations during farmer field days • Training in workshops
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Inco-operating applied and adaptive Research to test, validate and release mulching technology in Cowpea varieties • A platform for interaction of Cowpea value chain stakeholders • Availability of plant or crop residues for organic mulches. • Size of the land which is reducing due to family subdivisions. • Competing with livestock for crop residues used for mulching. • Synthetic material for mulching • Cost of materials • Disposal of material after use.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALF&I), County government extension services; to provide link with farmers • Community farmer groups play coordination role for ease in problem identification and dissemination
C: Current situation and future scaling up	
Counties where already promoted	Not yet promoted
Counties where TIMP will be promoted	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the agronomic practice • Labour intensity and availability of organic mulching materials • Lack of enough plant and crop residues due to competing uses of organic mulches. • Possibilities of insect build up categorized as pest or

	<p>disease vectors or weed seeds in organic mulches.</p> <ul style="list-style-type: none"> Organic mulches need frequent replacement to suppress weeds for a longer duration
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Establish Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders Promote mulching in cowpea through farmer field days and demonstrations Promote crop diversification to increase availability of organic mulches. Establish and follow a good integrated weed management control program for cowpea varieties. Adapting alternative mulching materials like high absorbance polymers to reduce insect build up.
Lessons learned	<ul style="list-style-type: none"> 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 varieties Creation of awareness through demonstrations and farmer field days help in adoption of IWM technology Availability of market is essential Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms There is need to adapt alternative mulching technologies in addition to organic materials like straws dry leaves, and dry grass.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> Practice is socially acceptable and is Environmentally friendly Increased productivity will provide continuous supply to the markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About Ksh 40,000/ acre
Estimated returns	About 800-4,000 kg/acre. Ksh 64,000 - 320,000/acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> The practice uses remnants from previous crops/plants that may offer competition in terms of fuelwood and livestock thus bringing a conflict for those performing the specific tasks, e.g. women in case of fuelwood and men for livestock feed. This will negatively affect the adoption and scaling up Since the activity is labour intensive it may increase the labour burden for the various gender category especially women who are already overburdened The TIMP will reduce women's weeding time that can be used performing other productive activities
Gender related opportunities	<ul style="list-style-type: none"> The TIMP can offer employment opportunities for the youths.

	<ul style="list-style-type: none"> Mulching reduces weeds thus women who perform most of the weeding activities will be relieved to perform other equally demanding economic activities
Vulnerable and Marginalized Groups (VMG) issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Though easy to use, it is be a bit labour intensive for VMGs, hence its adoption and scaling up may be an uphill task
VMG related opportunities	<ul style="list-style-type: none"> Mulch is locally available on-farm, and thus has very low costs implying that all including VMGs can take advantage of the practice.
E: Case studies/profiles of success stories	
Success stories	Farmers in different value chains have reported improved soil conditions, reduced runoff and nutrient loss, soil moisture retention in the soil and generally increased crop production following application of mulching technology.
Application guidelines for users	<ul style="list-style-type: none"> Sinchana JK and Raj SK. A review on integrated approach for the management of weeds in Cowpea (<i>Vigna unguiculata</i>). Journal of Applied and Natural Science. 2020;12(4):504 - 510. https://doi.org/10.31018/jans.v12i4.238 Plant clean Cowpea seeds in clean seed beds Apply mulch between the rows of Cowpeas. <p>Mulch management Hand pull or kill weeds that grow out of the mulch.</p>
F: Status of TIMP readiness (1=Ready for upscaling; 2=Requires validation; 3=Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI. Tel:+254-0721822312 E-mail: cd.narl@kalro.org
Lead organization and scientists	KALRO, Mwangi H.W., Momanyi V.N. and Kuruma. R.W
Partner organizations	County governments Public-Private-Partnerships

2.7.20. Herbicide (Chemical)Weed Control

TIMP Name	Herbicide (Chemical)Weed Control
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	

Problem addressed	Competition from weeds resulting from wrong timing and poor method of weed control prevents Cowpea from getting nutrients, soil moisture and space resulting in weak and stunted growth that reduces yields.
What is it? (TIMP description)	Chemical weed control is a technique that involves the application of herbicides to weeds or soil to kill, control germination or growth of the weeds. It is the cheapest and economically viable option for weed control due to high efficacy, large area coverage, easiness in application and in areas where intercultural operations is not possible due to shortage of labour. It reduces the cost of tillage operations for weed control, kills the weeds in situ without any dissemination of vegetative propagules and effectively controls brush and perennials weeds. However, the technology requires intensive knowledge on herbicide mode of action, selectivity, favourable conditions for application to be effective, type of soil, when to apply and how to apply. Only recommended herbicides listed by Pesticide Control and product Board (PCPB) should be used. Pre-planting herbicides include Lasso® combined with Farmuron® applied on the soil of a clean seed bed one to two weeks before planting Cowpea prevents weed seeds from germinating.
Justification	<p>Manual land preparation and hand weeding is very labour intensive yet labour is scarce and expensive.</p>  <p><i>Hand Herbicide application</i></p> <p>Appropriate use of herbicides reduces toil and allows timely weed control. Several selective herbicides are registered for control of annual and perennial weeds in Cowpea. Other post emergence herbicides are applied in middle rows using a hood to avoid crop injury. Proper sprayer calibration is critical to maintain correct sprayer pressure, flow rate from each nozzle and walking speed.</p>
Counties promoted	
Counties where TIMP will be upscaled	Turkana

B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers and extension agencies
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools(FFBS) • Agricultural Innovation Platforms (AIP) • On-farm experimentation and dissemination • Field days, shows, • Farmer to farmer communication • leaflets, larger plot demonstrations • Training on safe use of herbicides.
Most effective approach	On-farm experimentation and larger plot effect demonstrations.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release herbicide weed control in Cowpea production • A platform for interaction of Cowpea value chain stakeholders • Capacity building and training on safe use of herbicide for all users
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Public and private partners such as Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALF&I) for extension, • Chemical companies and agrodealers. • FIPs (Farmer Input Promotion) for promotion. • Farmer Groups for activity implementation and promotion. • Service provider agencies e.g. Micro-finance agencies and banks for credit provision, agro-vets for input supply. • Processors and manufacturers to create market for produce, and others e.g. NGOs, CBOs, and FBOs to provide special services like community mobilization, nutrition training, value addition etc.
C: Current situation and future scaling up	
Counties where already promoted	
Counties where TIMP will be promoted	Turkana
Current extent of reach	Validation of these herbicides needs to be done under different agroecological zones and soils before recommendations are given to the farmers.
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the agronomic practice • Limited knowledge and information and low literacy levels among the farmers or sprayers to read and interpret label instructions. • Capacity building is required to impart knowledge and

	<p>skills in safe use and application of herbicides.</p> <ul style="list-style-type: none"> • The farmers need to understand the proper use and application of herbicides to avoid buying inappropriate herbicides and thus minimize human health, environmental and social hazards. • Herbicide resistance
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Establish Cowpea innovation platforms • Promotion of chemical weed control • Train the agricultural extension county officers as ToTs on appropriate use of herbicides for them to train farmers on safe use of herbicides. • Proper use of herbicides as indicated on the label to avoid resistance
Lessons learned	<ul style="list-style-type: none"> • 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 chemical weed control technology • Consumers concerns of herbicide residues in the soil and subsequent crops needs attention • Availability of market is essential • Partnership is important in technology dissemination and adoption which can be facilitated through innovation platforms • Access to and use of information on chemical weed control will reduce labour and cost of weed management. It could give room to increased area under cultivation and thus increase in productivity.
Social, environmental, policy and market conditions necessary	Sensitization of communities on alternative methods of weed control and appropriate use of herbicides is vital.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About Ksh 15,000/ acre
Estimated returns	About 800-4,000 kg/acre. Ksh 64,000 - 320,000/acre
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	<ul style="list-style-type: none"> • Men and young boys perform most of the spraying activities hence this may reduce the women work burden • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for the youths in spraying

Vulnerable and Marginalized Group (VMG) issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land and credit, • 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	<ul style="list-style-type: none"> • Opportunities exist for those recovering from substances (drug abuse) in spraying • Use of herbicides will improve weed management leading to increased productivity, increase availability of Cowpeas for consumption which will improve food security hence improved
E: Case studies/profiles of success stories	
Success stories	Not yet adopted by smallholders
Application guidelines for users	<p>Sinchana JK and Raj SK. A review on integrated approach for the management of weeds in Cowpea (<i>Vigna unguiculata</i>). Journal of Applied and Natural Science. 2020:12(4):504-510.</p> <p>https://doi.org/10.31018/jans.v12i4.2386</p> <p>Rational use of herbicides. Eco friendly Weed Control options for Sustainable Agriculture. Science Alert. Review article. Scialert.net/fulltext/?</p> <p>Follow instructions on the pesticide label</p> <p>Weed control leaflets/ manuals. Information and instructions always displayed on the labels attached to container on how to use.</p>
F: Status of TIMP Readiness (1. Ready for up-scaling; 2. Requires validation; 3. Requires Research)	Requires validation and more research especially on pesticide residues in the crop and soil
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI.</p> <p>Tel:+254-0721822312</p> <p>E-mail: cd.narl@kalro.org</p>
Lead organization and scientists	<p>KALRO,</p> <p>Mwangi H.W., Momanyi V.N. and Kuruma. R.W</p>
Partner organizations	MoALF&I in Counties, Chemical companies.

2.7.21. Solarization Bed for Weed Control in cowpea

TIMP Name	Solarization Bed for Weed Control in cowpea
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Poor weed management practices that promote competition with the crop for nutrients causing weak and stunted growth in Cowpea that lead to yield losses.
What is it? (TIMP description)	Solarization is a method where a transparent polythene film is used and it increases soil temperatures by 10 ⁰ C or more to kill weed seeds and seedlings. Basic phenomena is building up of lethally high temperatures in top soil to kill dormant and viable seeds present. The Mechanism is mainly breaking dormancy of weed seeds and solar scotching of emerged weed seedlings that directly kill weed seeds by heat. The mechanism can increase soil temperature by 8-12 °C over non mulched soil. Rhizomes of perennial weeds may be killed if not deeply buried. Effectiveness is species specific and also depends on the length of the heating period.
Justification	Soil solarization reduces weed infestation in cowpea cropping systems. It is successful in controlling stubborn perennial weeds such as sedges and couch grass in Cowpea when done for two or three consecutive years. Use of 0.05mm T Polythene sheets for 40 days is more effective in controlling weeds than 0.01mm polythene that takes shorter time duration. Solarization is a good ecological and environmentally friendly method sustainable for small scale growers doing organic farmers.
Region promoted	Not yet promoted
Counties where TIMP will be upscaled	Turkana
B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers and extension agencies
Approaches used in dissemination	<ul style="list-style-type: none"> Farmer field and business Schools(FFBS) Agricultural Innovation Platforms (AIP) On-farm experimentation and dissemination Farmer field days, shows Farmer to farmer communication Leaflets, manuals, brochures larger plot demonstrations and training on how to use solarization in Cowpea farming.
Most effective approach	On-farm experimentation and larger plot effect demonstrations.
Critical/essential factors for	<ul style="list-style-type: none"> Applied and adaptive Research to test, validate and release solarization bed technology for weed control in

successful promotion	<p>Cowpea varieties</p> <ul style="list-style-type: none"> • A platform for interaction of Cowpea value chain stakeholders • Development of the agronomic practice for Cowpea farming • Capacity building and training on use of polythene and solar power.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Public and private partners, Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALF&I) for extension, • Chemical companies for back stopping. • FIPs (Farmer Input Promotion) for promotion. • Farmer Groups for activity implementation and promotion. • Service provider agencies e.g. Micro-finance agencies and banks for credit provision. • Processors and manufacturers to create market for produce, aggregators e.g. CARD (Community Action for Rural Development) for economy of scale sales and marketing), and others e.g. NGOs, CBOs, and FBOs to provide specialist services like community mobilization, nutrition training, value addition experts etc.
C: Current situation and future scaling up	
Counties where already promoted	
Counties where TIMP will be promoted	Turkana
Current extent of reach	Validation of solarization technology in Cowpea needs to be done before it is recommended to the farmers.
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the agronomic practice • Limited knowledge, information and low literacy levels among Cowpea farmers. • Capacity building is required to impart knowledge and skills in appropriate use and application of solarization. • Purchase of inappropriate polythene and improper disposal of the polythene paper.
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Establish Cowpea innovation platforms • Promotion of the technology • There is need to train the agricultural extension county officers as ToTs on appropriate use of solarization. They will then train the farmers. • Capacity build the farmers and CBFs on proper use of the technology • Polythene disposal should be done carefully to avoid environmental, health and social hazards. Liaise with the Agricultural extension and environmental officers

	on the ground for farmer empowerment and guidance on polythene reuse and disposal.
Lessons learned	<ul style="list-style-type: none"> • 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 of Solarization bed for weed control • Availability of market is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms. • Access to and use of information on different methods of weed control will reduce manual labor and cost of weed management. It could give room to increased area under cultivation and thus increased productivity.
Social, environmental, policy and market conditions necessary	Sensitization of communities on alternative methods of weed control and appropriate use of polythene is very necessary.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About Ksh 40,000/ acre
Estimated returns	About 800-4,000 kg/acre. Ksh 64,000 - 320,000/acre
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	<ul style="list-style-type: none"> • Lack of finances and credits for purchase of big polythene sheets • Women have less access to information, technology and knowledge • Women have less access to land that can be used for Cowpeas farming than men • Women and youth have limited access to education, training and extension services than men
Gender related opportunities	<ul style="list-style-type: none"> • Service provider agencies e.g. Micro-finance agencies and banks for credit provision • Women stand to benefit in increased production due to timely operations, increased yields and sales
Vulnerable and Marginalized Groups (VMG) issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land and credit • 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	<ul style="list-style-type: none"> • Use of this technology will improve weed management leading to increased productivity, increase availability of Cowpeas for consumption which will improve food security hence improved health of VMGs; high value of

	crop will lead to economic empowerment of VMGs
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Muhammad AK <i>et al.</i> An approach to organic weed management. <i>J. Communications soil science and plant analysis</i>. 2012;43:1847-60. DOI:10.1080/DOI03624</p> <p>Ali El Keblawy and Hamadi F.A (2009). Assessment of the differential response of weeds to soil solarization by two methods (2009). Research gate.net publications-230177258. <i>J. Weed biology and Management</i>.</p> <p>Maia Júnior, SO, Andrade JR, Reis LS, Santos CM, Silva LKS and Martins GMC. Weed Control by Solarization and Mulching in Cowpea Development. <i>Revista de Agricultura Neotropical, Cassilândia-MS</i>. 2020;(7)3:1-7. https://www.semanticscholar.org/. DOI:10.32404/rean.v7i3.3938Corpus.</p> <p>Weed control leaflets/ manuals. Information and instructions always displayed on the labels attached to container on how to use.</p>
F: Status of TIMP Readiness (1. Ready for up-scaling; 2. Requires validation; 3. Requires Research)	Requires validation and more research
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI.</p> <p><u>Tel:+254-0721822312</u></p> <p>E-mail: cd.narl@kalro.org</p>
Lead organization and scientists	<p>KALRO,</p> <p>Mwangi H.W., Momanyi V.N. and Kuruma. R.W</p>
Partner organizations	MoALF in Counties, Chemical companies.

2.7.22. Stale seed bed for Weed control in cowpea

TIMP Name	Stale seed bed for Weed control in cowpea
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Wrong timing and poor weed control management hasten weed infestation. Competition from weeds prevents the young sensitive cowpea crop from getting available resources which interferes with the growth leading to yield losses.


What is it? (TIMP description)	<p>Stale seed bed is where seeds are allowed to germinate by giving pre-sowing irrigation or rainfall and emerged weeds are destroyed using non-selective herbicides or by pre-plant tillage practices (1-2 flushes of the weeds) before planting.</p> <p>the weeds. Non-residue paraquat may be used to destroy dense flush young weed seedlings followed by planting the crop. Most weed seeds have the potential to develop where there is adequate soil moisture and temperature of 50°F at a depth of 2 inches. Several passes can be made in soil using roto Spike tooth hallow implement to destroy emerging weeds during preparation of stale beds. When weed seeds germinate they are desiccated or ploughed. The success of stale seedbed (SSB) in controlling weeds is influenced by the method of seedbed preparation, weed species present, the method adopted to kill the emerged weeds, environmental condition and the duration.</p>
Justification	With sound knowledge of weed phenology and factors like temperature, irrigation and humidity at the local level it is possible to predict when certain weeds will raise problems in Cowpea seedbed. Solarization will kill weeds before planting, and thus reduce competition from weeds, which will hasten growth of the crop and increase yields.
Region promoted	Applied in rice where weeds are killed by flooding before planting
Counties where TIMP will be upscaled	Turkana
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers and extension agencies
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Training workshops, Seminars, Meetings • On-farm experimentation and dissemination • Field days, shows, farmer to farmer communication, leaflets, larger plot demonstrations, training on how to use stale bed.
Most effective approach	On-farm experimentation and larger plot effect demonstrations.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release stale seed bed for weed control in Cowpea varieties • A platform for interaction of Cowpea value chain stakeholders • Capacity building and training on use of stale bed
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Public and private partners Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALF&I) for extension, • Chemical companies for back stopping.

	<ul style="list-style-type: none"> • FIPs (Farmer Input Promotion) for promotion. • CBF, Farmer Groups for activity implementation and promotion. • Service provider agencies e.g. Micro-finance agencies and banks for credit provision, agro-vets for input supply. • Processors and manufacturers to create market for produce, aggregators e.g. CARD (Community Action for Rural Development) for economy of scale sales and marketing], and others e.g. NGOs, CBOs, and FBOs to provide specialist services like community mobilization, nutrition training etc.
C: Current situation and future scaling up	
Counties where already promoted	Not yet promoted
Counties where TIMP will be promoted	Turkana
Current extent of reach	Validation of stale beds technology needs to be done before recommending to the farmers.
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the technology • Labour intensive • Limited knowledge and information and low literacy levels among the farmers. • Capacity building is required to impart knowledge and skills in safe use and application of stale beds. • Inappropriate and unsafe use herbicides
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Establishment of Cowpea innovation platforms • Promotion of technology through CBF, • Train the agricultural extension county officers as ToTs to help train farmers on appropriate use of stale beds. • Train farmers on safe/ correct way to use herbicides
Lessons learned	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Awareness creation through demonstrations and farmer field days help in adoption of Stale seed bed technology • Availability of market for the produce is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Consumers concerns of herbicide residues in the soil and subsequent crops needs attention • Access to and use of information on IPM will reduce labor and cost of controlling weeds. This could increase area under cultivation and yields.


Social, environmental, policy and market conditions necessary	Sensitization of communities on alternative methods of weed control and appropriate use of stale beds is very necessary.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About Ksh 25,000/ acre
Estimated returns	About 800-4,000 kg/acre. Ksh 64,000 - 320,000/acre
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for Cowpeas farming than men • Women and youth have limited access to education, training and extension services than men
Gender related opportunities	<ul style="list-style-type: none"> • Women stand to benefit in increased production due to increased yields and sales
Vulnerable and Marginalized Group (VMG) issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land and credit • 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	<ul style="list-style-type: none"> • Use of this technology will improve weed management leading to increased productivity. Increase availability of Cowpeas for consumption which will improve food security hence improved health of VMGs; high value of crop will lead to economic empowerment of VMGs
E: Case studies/profiles of success stories	
Success stories	.
Application guidelines for users	<p>Sinchana JK and Raj SK. A review on integrated approach for the management of weeds in Cowpea (<i>Vigna unguiculata</i>). Journal of Applied and Natural Science. 2020;12(4):504 - 510. https://doi.org/10.31018/jans.v12i4.2386</p> <p>Gnanavel I and Kathiresan RM. Eco-friendly weed control options for sustainable agriculture- a review. Agricultural Reviews. 2014;35(3):172-183.</p> <p>Singh G, Aggarwal N and Ram H. Efficacy of post-emergence herbicide imazethapyr for weed management in different mung bean cultivars. Indian Journal of Agriculture Science. 2014;84:540-543.</p>

	Weed control leaflets/ manuals. Information and instructions on pesticide labels indicating how to use.
F: Status of TIMP Readiness (1. Ready for up-scaling; 2. Requires validation; 3. Requires Research)	Requires validation and more research.
G: Contacts	
Contacts	Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI. Tel:+254-0721822312 E-mail: cd.narl@kalro.org
Lead organization and scientists	KALRO, Mwangi H.W., Momanyi V.N. and Kuruma. R.W
Partner organizations	Ministry of Agriculture, Livestock, Fisheries & Irrigation (MOALF&I) in Counties, Chemical companies, Agrodealers.

2.7.23. Mechanical/ Manual weeding

TIMP Name	Mechanical/ Manual Weed Control in Cowpea
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	<p>Incorrect timing and poor manual weeding hasten weed infestation. Competition from the weeds prevents growth of the young sensitive crop from getting available resources and thus leads to yield losses</p>  <p>Manual weeding in cowpea Source: Rose Wangari Kuruna</p>

What is it? (TIMP description)	An innovation that uses hand tools to prepare a weed free seedbed before planting and to remove weeds from the crop. The intra row weeds are removed by hand pulling or shallow digging. The weeds dry when uprooted and exposed to the sunshine.
Justification	Manual tillage and weeding is the most common method adopted by farmers to remove the weeds in cowpea crop. Weeds when not controlled take over, win the competition and cause Cowpea yield losses. Deep tilling brings dormant weed seeds to the surface thereby promoting germination. Fine soil/ tilth allow weed seeds to grow rapidly and roots to spread easier than compact soils. The emerged weeds can then be destroyed by mechanical hand weeding. Timely weeding is most effective at third and sixth weeks after planting depending on weed infestation. Delayed hand weeding after complete ground coverage and during the reproductive stage may cause physical injury to the roots and crop resulting in a significant reduction of cowpea pod yield.
Region promoted	All areas where Cowpea is grown.
Counties where TIMP will be upscaled	Turkana
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers and Agricultural extension officers.
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • On-farm experimentation and dissemination • Field days, shows, farmer to farmer communication • Manuals, leaflets, brochures • Larger plot demonstrations.
Most effective approach	On-farm experimentation and larger plot effect demonstrations.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved mechanical weeding in Cowpea varieties • A platform for interaction of Cowpea value chain stakeholders • Participatory Implementation, stakeholder sensitization.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Public and private partners such as Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALF&I) for extension, • Processors and manufacturers to create market for produce, aggregators e.g. CARD (Community Action for Rural Development) for economy of scale sales and marketing, and others e.g. NGOs, CBOs, and FBOs to provide specialist services like community mobilization, nutrition training etc.
C: Current situation and future scaling up	


Counties where already promoted	All counties growing cowpea
Counties where TIMP will be promoted	Turkana
Current extent of reach	Limited research done on gender responsive weeding implements.
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Labour intensity • Low use of agronomic practices • Appropriate implements are not readily available in the market such as subsoilers.  <p><i>Subsoiling using a subsoiler for minimum soil disturbance</i> Source: Violet Momanyi</p>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Work with Jua Kali industries for fabrication of appropriate subsoiling implements. • Promotion of the technology through CBF, FFSs • Liaise with Jua kali sector to make the right tools for subsoiling
Lessons learned	<ul style="list-style-type: none"> • 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 technologies • Availability of market for the produce is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Appropriate weeding tools (technology) will provide timely weed control with reduced drudgery to enhance

	Cowpea crop production.
Social, environmental, policy and market conditions necessary	Community sensitization on mechanical weed management practices for young plants sensitive to weed competition.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About Ksh 40,000/ acre
Estimated returns	About 800 - 4,000 kg/acre. Ksh 64,000 - 320,000/acre
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for Cowpeas farming than men • Women and youth have limited access to education, training and extension services than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for women employment in mechanical weeding
Vulnerable and Marginalized Group (VMG) issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • 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	<ul style="list-style-type: none"> • VMGs will benefit from consumption of health Cowpeas hence improved nutrition
E: Case studies/profiles of success stories	
Success stories	All areas growing Cowpea.
Application guidelines for users	Adigun J, Osipitan AO, Lagoke ST, Adeyemi RO and Afolami SO. (2014). Growth and yield performance of cowpea (<i>Vigna unguiculata</i> (L.) Walp) as influenced by row-spacing and period of weed interference in South West Nigeria. Journal of Agricultural Science. 2014; 6 (4): 188-198. DOI: 10.5539/jas.v6n4p188 ToT Manuals to include weed management TIMPs.
F: Status of TIMP Readiness (1. Ready for up-scaling; 2. Validation 3. Requires further research)	1) Ready for up-scaling
G: Contacts	
Contacts	Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI. Tel:+254-0721822312

	E-mail: cd.narl@kalro.org
Lead organization and scientists	KALRO, Mwangi H.W., Momanyi V.N. and Kuruma. R.W
Partner organizations	MoALF&I in Counties

2.7.24. Crop Rotation in Cowpea

TIMP Name	Crop Rotation for weed control in Cowpea
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Diverse weed species and rich weed seed banks in Cowpea cropping systems contribute to high yield losses due to weed competition with the cowpea crop.
What is it? (TIMP description)	<p>A good successive weed control strategy starting with a Farm Plan with a rotation schedule incorporated for optimal Cowpea production. Land is divided into a number of distinct areas with a planned sequence of crops growing in the same field rotated every year.</p> <p>. Rotation adds diversity to the cropping system, increases sustainability, of the system and provides the foundation of long term weed management.</p> <p>Rotation is critical in order to obtain good weed control in the crop but emphasis before making decision should be on environment, weeds present, time of year, crop rotation, irrigation methods and herbicide cost. Good rotation is achieved by combining cultural and chemical (herbicide) weed management strategies.</p> <p>Two options 1.) Form beds well before planting, Kill flush weeds using a post emergence herbicide or shallow weeding. 2.) Make clean beds just before planting and remove any emerged weeds or use pre-plant herbicides such as glyphosate and paraquat depending on weeds present, stage of weed growth and herbicide cost. Appropriate herbicides that target specific weeds include Glyphosate at a rate of 0.3-1.0 L/ha. A hooded sprayer is used to kill weeds within Cowpea rows to control emerged weeds when still small to reduce weeding costs.</p> <p>Effective weed management must be done before planting Cowpea.</p> <p>Detailed weed information (annual broad leaved or grasses) recorded or maps kept over time help improve management decision in Cowpea rotation.</p>
Justification	Planting a wide variety of crops with varied characteristics reduces the likelihood that specific weed species will become

	<p>adapted to the system and become problematic. The successive rotation systems for weed suppression is somehow based on the use of crop sequences that employ varying patterns of resources competition, allelopathy interference, soil disturbance and mechanical damage to provide an unstable and frequently inhospitable environment that provides the proliferation of a particular weed species. Correct timely crop rotation minimizes weed population in current Cowpea crop and reduces weed seed banks so there is less future infestations. Different crops grown in rotation break the cycle of weeds. The diversity of weed management strategies used for different crops also increases weed diversity and reduces prevalence of problematic weeds that can build over time.</p>  <p><i>Cowpea and maize on pure stand. Will be rotated the following year</i></p> <p><i>Source: Joshua Marube Omundi.</i></p>
Region promoted	All areas where Cowpea is grown.
Counties where TIMP will be upscaled	Turkana
B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers and Agricultural extension officers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • On-farm experimentation and dissemination • Field days, shows, farmer to farmer communication • Leaflets, brochures, larger plot demonstrations.

Most effective approach	On-farm experimentation and larger plot effect demonstrations.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release rotation practice in Cowpea varieties • A platform for interaction of Cowpea value chain stakeholders • Participatory Implementation, sensitization of stakeholders.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Public and private partners such as Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALF&I) for extension • Jua Kali artisans • Processors and manufacturers to create market for produce, aggregators e.g. CARD (Community Action for Rural Development) for economy of scale sales and marketing], and Others e.g. CBFs, NGOs, CBOs, and FBOs to provide specialist services like community mobilization, nutrition training etc.
C: Current situation and future scaling up	
Counties where already promoted	All counties practice crop rotation
Counties where TIMP will be promoted	Turkana
Current extent of reach	Limited research done on appropriate rotations for Cowpea cropping systems.
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the technology • Labour intensity • Small land for crop rotation schedules due to family subdivisions.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Information dissemination on the practices • Promotion of the technology in the suitable areas • Work with farmers to validate known schedules from other researchers or counties in different Cowpea growing regions. • Families to collaborate, work as a team and rotate crops in different family portions every year
Lessons learned	<ul style="list-style-type: none"> • 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 • Availability of market is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through

	innovation platforms <ul style="list-style-type: none"> • Crop rotation will provide timely weed control which will enhance crop production.
Social, environmental, policy and market conditions necessary	Sensitization of communities on Cowpea rotation practices in weed management
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About Ksh 30,000/ acre
Estimated returns	About 800-4,000 kg/acre. Ksh 64,000 - 320,000/acre
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	<ul style="list-style-type: none"> • 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 than men • Women have less access to agricultural information, technology and knowledge • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in production and marketing
Vulnerable and Marginalized Group (VMG) issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seed potato cuttings • 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	<ul style="list-style-type: none"> • Opportunities exist for youth exists in transporting the produce
E: Case studies/profiles of success stories	
Success stories	Cowpea farmers in Kitui and Ukambani Counties.
Application guidelines for users	<p>Lengwati DM, Mathews C and and Dakora FD. Rotation Benefits from N₂-Fixing Grain Legumes to Cereals: From Increases in Seed Yield and Quality to Greater Household Cash-Income by a Following Maize Crop. <i>Front. Sustain. Food Syst.</i> 2020;(4) 94:1-16. doi: 10.3389/fsufs.2020.00094.</p> <p>Ennin SA, Asafu-Agyei JN, Dapaah HK and Ekyem SA. Cowpea rotation with maize in cassava-maize intercropping systems. <i>Tropical Agriculture.</i> 2001; 78(4):218-225.</p> <p>Production manuals to include crop rotation weed management</p>

	TIMP
F: Status of TIMP Readiness (1. Ready for up-scaling; 2. Validation 3. Requires further research)	2. Ready for validation
G: Contacts	
Contacts	Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI. Tel:+254-0721822312 E-mail: cd.narl@kalro.org
Lead organization and scientists	KALRO, Mwangi H.W., Momanyi V.N. and Kuruma. R.W
Partner organizations	ICRISAT Nairobi; MoALF in Counties

2.7.25. Safe Use of herbicides

TIMP Name	Safe Use of herbicides
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Excessive herbicide application on crops and the soil, use of herbicides without wearing the right Personal Protective Equipment (PPE), storage of herbicides in non-designated stores, wrong application techniques, spraying at the wrong times and against the wind direction, use without following guidelines on the labels (eg rate and Pre-Harvest Interval (PHI)), disposal of expired herbicides and empty containers, inadequate enforcement of global and national policies and regulation on use of pesticides.
What is it? (TIMP description)	Capacity building of farmers, crop protection teams on safe handling and use of herbicides right from transportation from the agro-dealers to storage in their houses, mixing procedures and their application in the field in order to ensure safety of the crop, the handler/ applicator and the environment at large. The technology includes proper methodologies for proper herbicide disposal to minimize pollution of the environment.

	 <p>Wear full protection when spraying Source: Hottensiah Mwangi</p>  <p>Partial protection is not allowed Source: Violet Momanyi</p>
Justification	<p>Cases of improper use and misuse of pesticides are very common in most agricultural areas though not well documented. Incidences of over use, improper handling that lead to exposure and poisoning of spray operators while spraying, use of inappropriate and leaking spray equipment that equally expose the operators to health risks, contamination of the water bodies and pesticide residues in produce above recommended MRLs has been reported. Most of these irregularities can easily be corrected through sensitization and capacity building forums for end users to be made aware of the best practices that should be used when handling herbicides and other pesticides. Reports have shown increased chronic diseases in human beings resulting from pesticide exposure.</p>
B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers, Cowpea producers
Approaches used in dissemination	<ul style="list-style-type: none"> Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Farmer trainings, farmer participatory demonstrations/


	farmer field schools, shows, trade fairs, Plant clinics, Pesticides spray Demonstrations.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and employ safe use of herbicide application in cowpea farming systems • A platform for interaction of Cowpea value chain stakeholders • Development of agronomic practices for Cowpea • Collaboration between all partners, willingness of farmers to adhere to proper guidelines. • Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers, farmer groups/ CBOs to participate in the implementation of the various technologies for Cowpea production, KALRO and Universities to develop the technologies and conduct ToTs. AAK, PCPB, KEPHIS.
C: Current situation and future scaling up	
Counties where technology is already being promoted if any	All areas where pesticides are used on farms
Counties where TIMP will be promoted	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of technology • Labour intensity and requires skilled man power • Change of mindset in favour of current practices maybe difficult to achieve. • Illiteracy and inadequate capacity to use herbicides correctly. Most farmers cannot read and interpret the labels properly resulting in misuse, overuse or underuse of the herbicides. • Use of banned pesticides from neighboring countries • Inadequate capacity by farmers and agrochemical companies to dispose herbicides (pesticides) properly
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Cowpea innovation platforms to facilitate interaction of farmers with relevant stakeholders • Promotion of safe use of pesticides • Form and train youth spray teams to be spraying at a fee • Train pesticide users on how to interpret information on the label. • Establishment of aggregation centres for pesticide containers • Establishment of training of Extension staff and lead farmers as ToT. • Mandated organizations to Increase surveillance along the border points, frequently confiscate expired and smuggled

	products and enforce the laws.
Lessons learned in upscaling if any	<ul style="list-style-type: none"> • 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 technologies • Availability of market for the produce is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Consumers concerns of herbicide residues in the soil and subsequent crops needs attention • Upscaling of this technology require young men and youth as sprayers due to it being more hazardous to females. Some of the aspects of this technology need a lot of capital to actualize. For instance, the collection and incineration of pesticide containers needs a lot of money that may not be accessible by most men or youth groups. • The illiteracy levels of some farmers may hinder the use of correct information/ knowledge in the use of herbicides in some areas.
Social, environmental, policy and market conditions necessary	Organized collective marketing channels is critical for benefits to be derived from the practice/ technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	
Estimated returns	
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Technology is not safe for use by expectant women and physically challenged people because of its hazardous/ dangerous nature. • Herbicides and protective gear are expensive and most farmers including women may not afford them. • Lack of knowledge by men and women on the dangers of herbicides especially on storage and disposal. • Women have less access to education resulting in their inability to read and interpret instructions on the herbicide labels especially on re-entry period after spraying and PHI. This can cause herbicides poisoning due to frequent exposure.
Gender related opportunities	<ul style="list-style-type: none"> • Formation of spray teams by young men who will charge a fee for praying services • Formation of surveillance/ scouting groups by women
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • These are dangerous products that may not be handled by vulnerable groups. • Herbicides are expensive for most youths and physically challenged groups that may not utilize them.

VMG related opportunities	<ul style="list-style-type: none"> • Safe use of herbicides can easily be undertaken by the youth as an enterprise by forming Spray teams in the wards of each county. • Youths to offer spray calibration services to farmers as an enterprise. • Youths to help in the collection of pesticide containers and assist in the incineration processes organized by AAK. • Youth to own and operate agro- chemicals that stock right pesticides and offer advisory services to farmers at the agrovet shops
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • The AAK has trained youth spraying teams that help in spraying of farms in a few counties thus reducing cases of inexperienced people being exposed to herbicides. • Some counties have aggregation centres by AAK for collection of pesticide containers. This has led to reduction of these containers on farms. • Safe use of Pesticide campaigns by AAK, PCPB, KALRO and MOLFI.
Application guidelines for users	<p>Momanyi, V. (2017). Guidelines for Safe and Effective Use of Pesticides. A book published by Lap Lambert Academic Publishing.</p> <p>Information from Plant Clinics (Plant Doctors)</p> <p>Guidelines, manuals, brochures, fact sheets from KALRO, CABI/ Plantwise, AAK and PCPB</p>
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Ready for upscaling
F: Contacts	
Contacts	<p>Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI.</p> <p>Tel:+254-0721822312</p> <p>E-mail: cd.narl@kalro.org</p>
Lead organization and scientists	<p>KALRO,</p> <p>Mwangi H.W., Violet N.M., Kuruma.W.R.</p>
Partner organizations	<p>Ministry of Agriculture, Livestock, Fisheries & Irrigation. (MOALFI), CABI, PCPB, AAK, KEPHIS, County Governments, Universities</p>

2.8 HARVEST AND POST HARVEST MANAGEMENT

2.8.1 Maturity Index and Harvesting Techniques

TIMP Name	Maturity Index and harvesting Techniques
Category (i.e. technology, innovation or management practice)	 <p>Management Practices</p>
A: Description of the technology, innovation or management practice	
Problem to be addressed	Losses due to immature harvesting and inappropriate harvesting modes
What is it? (TIMP description)	This is the identification of crop maturity stage and the gathering of the crop. It involves identification of harvesting index for the harvesting of the leaves and tender pods (for vegetables) and for grain (dry pods)
Justification	Incorrect timing of harvesting and inappropriate harvesting methods leads to losses of leaf and grain: Harvesting before the maturity of the crop, usually results in lower yields and quality. This may also result in higher chances of pest infestation during storage. Delay in harvesting of cowpea results in shattering of pods and other pest losses (birds, rats, insects, etc) and overmature leaf or green pods.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea producers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station demonstrations • Agricultural exhibitions • Field days • Agricultural shows • Innovation platforms • Farmer field and business school • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Adequate funding for promotion activities • Awareness of Valuechain and TIMP by target beneficiaries
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Agricultural Extension agents: Farmer sensitization, On farm and on station demonstrations • Market players to create demand and pull production • Farmer leaders: Group organization NGOs dealing with cowpea value chain to disseminate the practices
C: Current situation and future scaling up	


Counties where already promoted if any	Machakos, Kitui, Coastal regions
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	Limited knowledge on crop maturity indices
Suggestions for addressing the challenges	Capacity building on cowpea maturity indices and appropriate harvesting methods
Lessons learned in up scaling if any	Create awareness on benefit of appropriate maturity indices and harvesting modes
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Crop and practices are acceptable to target communities • Environmental conditions conducive to growing and handling of crop • Market is able to absorb extra crop emanating from high yields. • Policy environment will be friendly for growing and marketing of the crop
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Task rate in area of production
Estimated returns	About 200,000 per ha
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform almost all production activities such as weeding and harvesting and thus should be targeted for training and extension services • Women and youth have limited access credit to purchase the harvesting implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities in harvesting exist for the youths in transporting the produce to the market • Employment opportunities exist for women in harvesting the crop
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs may not be able to perform the task due to their disability • VMGs and youth have limited access credit to purchase the harvesting implements • VMGs and youth have limited access to education, training and extension services than men • VMGs have less access to agricultural information, technology and knowledge
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities in harvesting exist for the women • Employment opportunities in harvesting exist for the youths in transporting the produce to the market
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Capacity building in Kitui, Machakos and Mbeere South
Application guidelines for users	Cowpea training manual Postharvest handling leaflets
F: Status of TIMP readiness	Ready for upscaling

(1-ready for upscaling; 2-requires validation; 3-requires further research)	
G. Contacts	
Contacts	The Institute Director, KALRO-HRI Thika; E-mail: director.hri@kalro.org Institute Director-AMRI Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Gathambiri C., Kuruma R., Kihwaga C., Violet K., Wasilwa
Partner organizations	CARITAS, Farm concern

Research gaps

1. Estimate cost benefit of application of appropriate harvesting techniques


2.8.2 Drying of Cowpea Pods

TIMP Name	Drying of cowpea pods
Category (i.e. technology, innovation or management practice)	Management Practices 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Crop losses due to post harvest fungal infections pccassioned by high moisture content in the grain
What is it? (TIMP description)	This is the drying of the cowpea pods after harvesting to reduce moisture content. This reduces their suceptobility to fungal infections.
Justification	Well dried pods enhance threshing efficiency and reduce losses during storage
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea producers, extension personell
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station demonstrations • Agricultural exhibitions • Field days • Agricultural shows • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Adequate funding for promotion activities

	<ul style="list-style-type: none"> • Awareness of value chain and TIMP by target beneficiaries •
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Agricultural Extension: Farmer sensitization, On farm and on station demonstrations • Market players to create demand and pull production • Farmer leaders: Group organization NGOs dealing with cowpea value chain to disseminate the practices
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	Limited knowledge on maturity indices on maturity indices
Suggestions for addressing the challenges	Capacity building on cowpea drying before threshing
Lessons learned in up scaling if any	Create awareness on benefit of appropriate drying before threshing
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Crop and practices are acceptable to target communities • Environmental conditions conducive to growing and handling of crop • Market is able to absorb extra crop emanating from high yields. • Policy environment will be friendly for growing and marketing of the crop
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Will vary as per prevailing labour rates
Estimated returns	About 200,000/Ha
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access credit to purchase the required implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for the youths and women in performing the operation
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • 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 and youth have limited access to education, training and extension services than men • VMGs have less access to agricultural information, technology and knowledge
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for the youths in performing the operation.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Capacity building in Kitui, Machakos and Mbeere South

Application guidelines for users	Cowpea training manual, Postharvest handling leaflets Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea 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)	Ready for upscaling
G. Contacts	
Contacts	KALRO Gathambiri C., Kuruma R., Kihwaga C., Violet K., Wasilwa
Lead organizations and scientists	The Institute Director, KALRO-HRI Thika; E-mail: director.hri@kalro.org Institute Director-AMRI Email: director.amri@kalro.org
Partner organizations	CARITAS, Farm concern

2.8.3 Cowpea threshing and winnowing



TIMP Name	Cowpea threshing and winnowing
Category (i.e. technology, innovation or management practice)	Management Practices 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor quality of cowpea resulting in poor market prices
What is it? (TIMP description)	Threshing is the expelling of the cowpea seed from the pods by mechanical means. Winnowing is the cleaning of the grain to remove chaff, dust, foreign matter such as stones, broken grains, shrivelled, mouldy, insect damaged, rotten discoloured or faded, and any remaining plant parts. Cowpea can be threshed manually by beating the plants on a cement floor, or beating bagged pods with sticks once they are dry enough. Various types of threshing machines are available in different sizes, powered by petrol, diesel, or electricity, for small,

	<p>medium, and large scale threshing of cowpea. Irrespective of the method used, cowpea seed can be easily damaged if threshed too roughly or when too dry. When planted, damaged seed will produce weak, stunted plants and other abnormalities. Thresh the dry pods on a clean surface such as a tarpaulin and then dry the threshed grains on a clean surface for two sunny days.</p> <p>Dry cowpea grains are winnowed to</p>
Justification	Threshing and winnowing enhances the quality of cowpea grains and reduce losses due to contamination
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea producers and traders
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station demonstrations • Agricultural exhibitions • Field days • Agricultural shows • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Digital platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Adequate funding for promotion activities • Awareness of value chain and TIMP by target beneficiaries
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Agricultural Extension: Farmer sensitization, On farm and on station demonstrations • Farmer leaders: Group organization NGOs dealing with cowpea value chain to disseminate the practices
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	Limited knowledge on threshing and winnowing of cowpea grains
Suggestions for addressing the challenges	Capacity building on cowpea postharvest handling practices
Lessons learned in up scaling if any	Create awareness on benefit of appropriate postharvest handling
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Crop and practices are acceptable to target communities • Environmental conditions conducive to growing and handling of crop • Market is able to absorb extra crop emanating from high yields. • Policy environment will be friendly for growing and marketing of the crop
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Vary with task rate in area of production
Estimated returns	About 200,000/ha
Gender issues and concerns in	<ul style="list-style-type: none"> • Women perform most of the production activities including

development ,dissemination, adoption and scaling up	threshing and winnowing <ul style="list-style-type: none"> • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	Capacity building in Kitui, Machakos and Mbeere South
Application guidelines for users	Cowpea training manual Postharvest handling leaflets
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	The Institute Director, KALRO-HRI Thika; E-mail: director.hri@kalro.org Institute Director-AMRI Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Gathambiri C., Kuruma R., Kihwaga C., Violet K., Wasilwa
Partner organizations	CARITAS, Farm concern

2.8.4 Cowpea Grain Drying

TIMP Name	Cowpea Grain Drying
Category (i.e. technology, innovation or management practice)	Technology

	
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor quality and crop losses due to fungal contamination
What is it? (TIMP description)	<p>This is the reduction of moisture content of the grain through exposure to warm air currents.</p> 
Justification	Appropriate drying enhances the quality of cowpea grains and reduces losses due to contamination
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea producers and traders
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station demonstrations • Agricultural exhibitions • Field days • Agricultural shows • EFFBSMass media – Agricultural programs • AIP

Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Adequate funding for promotion activities • Awareness of value chain and TIMP by target beneficiaries
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Agricultural Extension: Farmer sensitization, On farm and on station demonstrations • Farmer leaders: Group organization NGOs dealing with cowpea value chain to disseminate the practices
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	Limited knowledge on drying of cowpea grains
Suggestions for addressing the challenges	Capacity building on cowpea drying practices
Lessons learned in up scaling if any	Create awareness on benefit of appropriate drying techniques
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Crop and practices are acceptable to target communities • Environmental conditions conducive to growing and handling of crop • Market is able to absorb extra crop emanating from high yields. • Policy environment will be friendly for growing and marketing of the crop
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Will vary wiy method used
Estimated returns	About 200000/ha
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the production activities including drying, threshing and winnowing • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	Capacity building in Kitui, Machakos and Mbeere South
Application guidelines for users	Cowpea Extension manual Postharvest handling leaflets
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	The Institute Director, KALRO-HRI Thika; E-mail: director.hri@kalro.org Institute Director-AMRI Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Gathambiri C., Kuruma R., Kihwaga C., Violet K., Wasilwa
Partner organizations	CARITAS, Farm concern

2.8.5 Cowpea grain storage

TIMP Name	Hermatic bag Cowpea grain storage
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Crop losses arising from by storage pests.
What is it? (TIMP description)	This is the proper and safe preservation of cowpea grain for future use in an airtight bag so as to suffocate any existing pests within by depriving them of air.
Justification	Appropriate storage enhances the quality of cowpea grains and reduce losses due to contamination and consumption by pests.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea producers and traders
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station demonstrations • Agricultural exhibitions • Field days • Agricultural shows • Mass media – Agricultural programs Promotional materials (posters/brochures/leaflets, manuals) • AIP
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Adequate funding for promotion activities • Awareness of value chain and TIMP by target beneficiaries
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Agricultural Extension: Farmer sensitization, On farm and on station demonstrations • Farmer leaders: Group organization NGOs dealing with cowpea value chain to disseminate the practices

C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	Limited knowledge on drying of cowpea grains
Suggestions for addressing the challenges	Capacity building on cowpea postharvest handling practices
Lessons learned in up scaling if any	Create awareness on benefit of appropriate storage methods
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Crop and practices are acceptable to target communities • Environmental conditions conducive to growing and handling of crop • Market is able to absorb extra crop emanating from high yields. • Policy environment will be friendly for growing and marketing of the crop
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Costs of bag and labour for filling
Estimated returns	About 200,000/ha
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the production activities including threshing, winnowing and drying • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for and women in performing the operation • Employment opportunities exist for and youth in arranging the grains in the store and transporting the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Employment opportunities exist for and women in performing the operation • Employment opportunities exist for and youth in arranging the grains in the store and transporting the produce to the market
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Capacity building in Kitui, Machakos and Mbeere South
Application guidelines for users	Cowpea Extension manual Postharvest handling leaflets

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	The Institute Director, KALRO-HRI Thika; E-mail: director.hri@kalro.org Institute Director-AMRI Email: director.amri@kalro.org
Lead organizations and scientists	KALRO, Gathambiri C., Kuruma R., Kihwaga C., Violet K., Wasilwa
Partner organizations	CARITAS, Farm concern


2.8.6 Postharvest handling practices of cowpea leaves

TIMP name	Postharvest handling practices of cowpea leaves
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem addressed	Loss of crop due to poor handling. Lack of information and expertise in cowpea postharvest handling practices of after which results in high postharvest losses
What is it? (TIMP description)	These are a set of postharvest handling practices for cowpea leaves. These include: <ul style="list-style-type: none"> • Sorting and grading • Pre-cooling at farm level • Packaging (plastic crates)
Justification	Cowpea are perishable produce that require careful handling from harvesting upto market to ensure maintenance of good quality. Farmers and other actors along the value chain do not follow recommended practices. This leads to high postharvest losses. There is need to sensitize farmers and other chain actors on importance of proper postharvest handling practices and build their capacity on best practices.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, extension service providers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer trainings • Field Demonstrations • Farmer Field Schools • Shows • Trade fairs • Digital platforms • AIP
Critical/essential factors for successful promotion	Good collaboration between all partners Adequate facilitation: Funds, Logistics (Transport)
Partners/stakeholders for scaling up and their	<ul style="list-style-type: none"> • Agricultural Extension: Farmer sensitization, On

roles	farm and on station demonstrations <ul style="list-style-type: none">• Market players to create demand and pull production• Farmer leaders: Group organization• NGOs dealing with cowpea to disseminate the practices
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMP will be upscaled	Turkana
Challenges in dissemination	Limited extension officers with knowledge on postharvest handling procedures
Suggestions for addressing the challenges	Training of TOTs
Lessons learned in up scaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary for up scaling	-Organized marketing channels is critical for benefits to be derived from technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Will vary with prevailing task rates in the growing areas
Estimated returns	About 20,000/ha per season
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none">• Women perform most of the production activities such as threshing, winnowing and handling of the leaves• Women and youth have limited access to education, training and extension services than men• Women have less access to agricultural information, technology and knowledge• Employment opportunities exist for and women in performing the operation• VMGs may not be able to perform the task due to their disability• Women have less access to agricultural information, technology and knowledge• VMGs have less access to agricultural information, technology and knowledge• Employment opportunities exist for and women in performing the operation
Gender related opportunities	
VMG issues and concerns in development and dissemination	
VMG related opportunities	
E: Case studies/profile of Success stories	
Success stories from previous similar projects	None
Application guidelines for users	Cowpea cultivation manual, brochures and factsheet with detailed guidelines on postharvest handling practices Cowpea extension Manual
F: Status of TIMP readiness 1) Ready for up scaling 2) Requires validation 3. Requires further research	Ready to upscaling
F: Contacts	
Contacts	The Institute Director, KALRO-HRI Thika; E-mail: director.hri@kalro.org

	Institute Director-AMRI Email: director.amri@kalro.org
Lead organization and scientists	KALRO, Gathambiri C., Kuruma R., Kihwaga C., Violet K., Wasilwa
Partner organizations	CARITAS, Farm concern

2.8.7 Cooling of cowpea leaves

TIMP name	Cooling of cowpea leaves
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Loss of crop due to spoilage and loss of freshness
What is it? (TIMP description)	Zero energy cooler is an evaporative cold storage that offers short time storage for fresh produce. It reduces the temperature and increases relative humidity during storage essential in maintaining the freshness of cowpea and prolong their shelf life.
 <p>Zero Energy Cooling Unit</p>	
Justification	Cowpea are highly perishable therefore they should be stored at low temperature and high relative humidity to enhance their shelf life. High temperature increases respiration rate and enhances postharvest rots. Cooling cowpea leaves at farm level improves the shelf life and maintains quality. Zero energy unit offers cost effective cold storage unit. The unit is developed using locally available materials that are environmental friendly.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, extension service providers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer trainings • Field Demonstrations • Farmer Field Schools • Shows • Trade fairs • AIP • Digital platforms
Critical/essential factors for successful promotion	Good collaboration between all partners Adequate facilitation: Funds, Logistics (Transport)
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Ministry of Agriculture-Extension Service, individual Farmers, farmer groups/CBOs, Youth Groups • Agricultural Extension: Farmer sensitization, On farm and on station demonstrations • Market players to create demand and increase production • Farmer leaders: Group organization • NGOs dealing with cowpea to disseminate the practices

C: Current situation and future scaling up	
Counties where already promoted if any	The technology has been promoted for other horticultural produce such tomatoes , Cowpeas in Tharaka Nithi, Embu and Machakos
Counties where TIMP will be upscaled	
Challenges in dissemination	Slow uptake of the technology due to lack of local artisans with the knowledge of construction
Suggestions for addressing the challenges	Training of local artisans on construction
Lessons learned in upscaling if any	Organized marketing channels is critical for benefits to be derived from technology
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none">• Crop and practices are acceptable to target communities• Environmental conditions conducive to growing and handling of crop• Market is able to absorb extra crop emanating from high yields.• Policy environment will be friendly for growing and marketing of the crop
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Returns from leaves are about 20,000/ha per season
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none">• Women and youth have less access to credit to purchase the required implement than men• Women and youth have limited access to education, training and extension services than men• Women have less access to agricultural information, technology and knowledge• Employment opportunities exist for and women and youth in performing the operation• VMGs have less access to credit to purchase the required implement than men• VMGs may not be able to perform the task due to their disability• Women have less access to agricultural information, technology and knowledge• VMGs have less access to agricultural information, technology and knowledge• Employment opportunities exist for and women in performing the operation
Gender related opportunities	
VMG issues and concerns in development and dissemination	
VMG related opportunities	
E: Case studies/profile of Success stories	
Success stories from previous similar projects	None
Application guidelines for users	The cooler should be well-constructed to maintain low temperatures and high humidity inside the unit
F: Status of TIMP readiness 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for up scaling
F: Contacts	
Contacts	The Institute Director, KALRO-HRI Thika;


	E-mail: director.hri@kalro.org Institute Director-AMRI Email: director.amri@kalro.org
Lead organization and scientists	KALRO, Gathambiri C., Kuruma R., Kihwaga C., Violet K., Wasilwa
Partner organizations	University of Nairobi, MOA, Traders, Processors

Research gap

3 Estimate cost benefit of application of appropriate postharvest management techniques

2.5.2 VALUE ADDITION OF COWPEA

2.9.1 Cowpea flour

TIMP Name	Cowpea flour
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low prices of cowpea grain.
What is it? (TIMP description)	<p>This is a milled dry product of cowpea grains. It is prepared by cleaning, sorting, drying, milling and packaging of the flour in airtight bags.</p> 
Justification	The cowpea grain has essential nutritional elements and is often considered the meat of the poor. In rural areas and low-income areas, malnutrition to children, the sick and elderly is high. This can be reduced by consumption of this flour. Processing cowpea into high quality flour provides opportunities for income generation and employment. The cowpea flour can be blended with other flours and diverse value-added products made to improve consumer acceptability
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on value addition of cowpea flour • Seminars to create awareness • Farmer exchange visits and study tours • Common Interest Groups (CIG) approach (Capacity building) • Establishment of collection centres • ICT (WhatsApp and mobile apps)
Critical/essential factors for	<ul style="list-style-type: none"> • Stakeholder capacity building and networks, promotions involving


successful promotion	<p>Public Private Partnerships (PPP)</p> <ul style="list-style-type: none"> • Availability of high-quality cowpea • Availability of quality standards • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpea into various products • The government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Inefficient market system • Inadequate information to stakeholders • Weak or non-existent stakeholder innovation platforms. • Cost of solar drying technology and packaging materials will increase cost of the production
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Carrying out adaptive trials to develop and package high quality cowpea flour technology • Involving other stakeholders in the manufacturing industry to provide affordable solutions for the drying and packaging technologies. • Capacity building farmers on cowpea value addition
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (traders of Cowpeaes) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Peeling, drying • Milling equipment • Costs of packaging materials
Estimated returns	Increased income and nutrition through production and sale of high quality cowpea flour
Gender issues and concerns in development and	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge

dissemination	<ul style="list-style-type: none"> • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea flour.
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally produced Cowpea flour-based products • Nutritious products can be made from cowpea flour contributing to the nutrition of VMGs. • Women can diversify family diet and generate income at village level by making the products for sale
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>High quality cowpea flour production leaflets</p> <p>Cowpea extension manual</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Requires validation	
G: Contacts	
Contacts	<p>The Centre Director</p> <p>Food Crops Research Centre – Muguga South</p> <p>P. O. Box 30148-00100, Nairobi, Kenya.</p>
Lead organization/scientists	KALRO-Muguga, Ndambuki J., Wayua F., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

Research gap

Lack of data on cost-benefit analysis and gross margins for cowpea flour production

2.9.2 Cowpea Biscuits

TIMP Name	Cowpea Biscuits
Category (i.e., technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grain, and low market prices
What is it? (TIMP description)	<p>It is the preparation of cowpea biscuit is from composite flour of 50% cowpea and 50% wheat flour.</p>  <p>Cowpea biscuits</p>
Justification	Processing of cowpea flour into biscuits will enhance consumption of cowpea, enhance demand and thus encourage increased production. Farm surpluses will not go into waste and value added products fetch high prices.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • Agricultural innovation platforms • On farm demonstration and training • Brochures on cowpea biscuit value addition • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • FFBS • Mobile platforms •
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); • Availability of high-quality cowpea products, • Availability of quality standards • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpea biscuits • The government should facilitate affordable credit to empower farmers take up cowpea agribusiness
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will benefit from the grants as they adopt the technologies.

	<p>They are the recipients of the technologies.</p> <ul style="list-style-type: none"> Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> Limited awareness of product by farmers and consumers Limited processing technology at the household level. Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities Limited consumer awareness of value added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Awareness creation about the product to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the product Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively. There is need for the government to facilitate affordable credit to empower farmers take up cowpea agribusiness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet estimated
Estimated returns	<ul style="list-style-type: none"> Reduced losses of excess cowpea Increased income through production and sale cowpea grains and leaves
Gender issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women have less access to information, technology and knowledge Women have less access to land that can be used for cowpea farming than men Women and youth have limited access to education, training and extension services than men Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> Women and youth stand to benefit in production, use and sale of cowpea biscuits
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> VMGs have less access to agricultural information, technology and knowledge VMGs have limited access to productive resources such as land, credit, and quality seed

	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally produced cowpea biscuits • Nutritious products can be made from cowpea flour contributing to the nutrition of VMGs. • Women can diversify family diet and generate income at village level by making the products for sale
E: Case studies/profiles of success stories	
Success stories	Nutritional demand of high protein baked products
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea production leaflets and brochures</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Require validation	
G: Contacts	
Contacts	The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO, Kuruma R., Ndambuki J., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea biscuit production

2.9.3 Cowpea/wheat chapatti

TIMP Name	Cowpea chapatti
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grain, and low market prices
What is it? (TIMP description)	Preparation of nutritious cowpea chapatti made from composite flour of 40% cowpea and 60% wheat flour.

	 <p>Cowpea chapatti</p>
Justification	Blending cowpea with wheat flour will reduce the cost of chapatti and diversify the use of cowpea. This will create demand for increased cowpea production for enhanced food security and income generation. This will also improve the nutrition status of the consumers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Shows • Exhibitions, • Farmer Field and Business Schools • Innovation Platforms (IP) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); • Availability of high-quality cowpea grains • Availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; • Government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing of chapati • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying cowpea chapattis.
C: Current situation and future scaling up	
Counties where already promoted, if any	

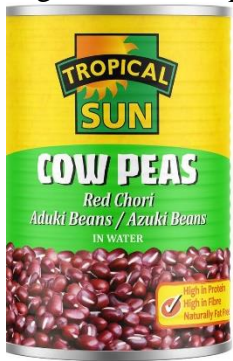
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of cowpea products by farmers and consumers • Limited processing technology at the household level. • Lack of credit facilities • Limited consumer awareness of value-added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, • Linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; • Provide nutrition education to consumers
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively. There is need for the government to facilitate affordable credit to empower farmers take up cowpea agribusiness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet estimated
Estimated returns	<ul style="list-style-type: none"> • Reduced postharvest losses • Increased income through production and sale cowpea grain
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in making and sale of cowpea chapati
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally produced cowpea chapatti

	<ul style="list-style-type: none"> Nutritious products can be made from cowpea flour contributing to the nutrition of VMGs. Women can diversify family diet and generate income through sale of the cowpea chapatti
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea chapatti production leaflets and manuals</p>
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 Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO Kuruma R., Ndambuki J.M., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> MoALFC (County Governments) CBOs and NGOs Hotels, restaurants, food processing companies Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea chapati production

2.9.4 Canned Cowpea

TIMP Name	Canned cowpea
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization and prof cowpea grain at industrial level, high postharvest losses and low market prices
What is it? (TIMP description)	<p>Canned cowpea is prepared from mature cowpea grain. It's made by sorting, washing the grain, boiling for 30 minutes, then packing in hot jars leaving 1 inch head space</p> 

	Canned cowpea Source:Tropical Sun
Justification	Canning of cowpeas enables long term preservation of cowpeas, transportation and use of the product in areas which do not produce it
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on canning of cowpeas • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • Farmer field and business school • Agricultural innovation platforms • Digital platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation • Stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP) • Availability and accessibility of high-quality cowpeas • Availability of quality standards
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties to facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing canned cowpea • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g., KEBS) – quality standards formulations and enforcement • Consumers – buying canned cowpea
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value-added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors.


	<ul style="list-style-type: none"> • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet estimated
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea grain • Increased income through production and sale cowpea grain
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in making and marketing of the canned cowpea hence earn more income
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • 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	<ul style="list-style-type: none"> • Opportunity for the VMGs exist in making, trading and consuming the locally produced canned cowpea • VMGs can benefit in marketing dry and packaged cowpea grains hence earn more income
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Canned cowpea production leaflets and manuals</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Require validation	
G: Contacts	
Contacts	The Centre Director

	Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for canned cowpea production

2.9.5 Cowpea Mandazi

TIMP Name	Cowpea Mandazi
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grains, high postharvest losses and low market prices.
What is it? (TIMP description)	<p>Cowpea mandazi made from composite flour of 50% cowpea and 50% wheat flour.</p>  <p>Cowpea mandazi</p>
Justification	Blending Cowpea with wheat flour will reduce the cost of mandazi and diversify the use of cowpea. This will create demand for increased cowpea production for enhanced food security and income generation. It will also save on money used to purchase wheat.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on cowpea mandazi recipe • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Agricultural innovation platform • Farmer field and business school • Establishment of collection centres • digital platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation • Stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP)


	<ul style="list-style-type: none"> • Availability of high-quality grains • Availability of quality standards
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – Cowpea mandazi processing • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing/buying cowpea mandazi
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • limited consumer awareness of value added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea grains • Increased income through production and sale mandazi

Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea mandazi
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made cowpea mandazi • Cowpea mandazi can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea mandazi production leaflets and brochures</p>
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 Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea mandazi production

2.9.6 Cowpea Buns

TIMP Name	Cowpea Buns
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grains, high postharvest losses and low market prices
What is it? (TIMP description)	<p>Cowpea buns made from composite flour of 20% Cowpea and 80% wheat flour.</p>  <p>The image shows two cowpea buns on the left, which are oval-shaped and have a reddish-brown, textured surface. On the right, there is a pile of many smaller, irregularly shaped cowpea buns that are golden-brown and appear to be fried or baked.</p> <p>Cowpea buns</p>
Justification	Blending cowpea with wheat flour will reduce the cost of buns and diversify the use of cowpea. This will create demand for increased cowpea production for enhanced food security and income generation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Agricultural shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); • Availability of high quality cowpea flour • Availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into


	various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing of cowpea bun • . • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying cowpea buns.
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level • Challenging in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, • Linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; • Nutrition education to consumers
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea grains

	<ul style="list-style-type: none"> Increased income through production and sale cowpea buns
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> Women have less access to information, technology and knowledge Women have less access to land that can be used for cowpea farming than men Women and youth have limited access to education, training and extension services than men Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> Women and youth stand to benefit in production, use and sale of cowpea buns
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Opportunity to produce, trade , and consume locally made cowpea buns Cowpea buns can be used to make cheap nutritious food products, which will lead to enhanced livelihoods
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea buns production leaflets and manuals</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Require validation	
G: Contacts	
Contacts	<p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.</p>
Lead organization/scientists	<p>KALRO, Kuruma R., Ndambuki J., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.</p>
Partner organizations	<ul style="list-style-type: none"> MoALFC (County Governments) CBOs and NGOs (e.g.) Hotels, restaurants, food processing companies Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea mandazi production

2.9.7 Cowpea fritters

TIMP Name	Cowpea fritters
	Innovations
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grains, high postharvest losses and low market prices
What is it? (TIMP description)	<p>Cowpea flour blended with wheat flour, eggs and spices. The combination is deep fried, cooled and packaged.</p>  <p>Cowpea fritters</p>
Justification	Diversification of cowpea products will enhance consumption of cowpea, enhance demand and thus spur increased production.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers.
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of cowpea grains • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • Farmer field and business school • Innovation platforms • ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, Stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP) • Availability of high-quality Cowpeas • Availability of quality standards.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing commercial cowpea fritters • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies.

	<ul style="list-style-type: none"> • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – Prepare/buying cowpea fritters
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea grains • Increased income through production and sale cowpea buns
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea fritters
VMG issues and concerns in	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology


development and dissemination	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made cowpea fritters • Cowpea fritters can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea fritters production leaflets and manuals</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Require validation	
G: Contacts	
Contacts	The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea fritters production

2.9.8 Cowpea Sprouts

TIMP Name	Cowpea sprouts
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 cowpea grain, high postharvest losses and low market cost
What is it? (TIMP description)	Cowpea grain are cleaned and soaked in warm water for 8 hours, then they are washed and placed in clean container and closed for one day to sprout. They are then packed and sold.

	 <p>Cowpeas sprout Source: Namdharis fresh</p>
Justification	Cowpea utilization is limited to boiling cowpea with maize. Diversification of cowpea grains will enhance consumption of cowpea, enhance demand and thus encourage increased production. Adding value to cowpea grain will also minimize wastage of farm surpluses and damaged roots unsuitable for sale as fresh produce. The cowpea grain can be processed into sprouts for both domestic use and sale.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of cowpea • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • Innovation platform • Farmer field and business school • Digital platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality cowpea products, availability of quality standards; • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will benefit from the grants as they adopt the technologies.

	<p>They are the recipients of the technologies.</p> <ul style="list-style-type: none"> Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> Limited awareness of product by farmers and consumers Limited processing technology at the household level. Difficulty in acquiring certificates from regulatory authorities Lack of standards for the product, lack of credit facilities, limited consumer awareness of value added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Awareness creation about the product to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the product Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively. There is need for the government to facilitate affordable credit to empower farmers take up cowpea agribusiness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet estimated
Estimated returns	<ul style="list-style-type: none"> Reduced losses of excess cowpea grain Increased income through production and sale cowpea buns
Gender issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women have less access to information, technology and knowledge Women have less access to land that can be used for cowpea farming than men Women and youth have limited access to education, training and extension services than men Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> Women and youth stand to benefit in production, use and sale of cowpea sprouts
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> 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


	<ul style="list-style-type: none"> • There is low adoption by VMGs due lack of awareness
VMG issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made cowpea sprouts • Cowpea sprouts can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
VMG related opportunities	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea sprouts production leaflets and manuals</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	<p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.</p>
Lead organization/scientists	<p>KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.</p>
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea fritters production

2.9.9 Cowpea noodles

TIMP Name	Cowpea noodles
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grains, high postharvest losses and low marketing prices
What is it? (TIMP)	Cowpea noodles made from composite flour of 30% Cowpea and 70%

description)	<p>wheat flour.</p>  <p>Cowpea noddles</p>
Justification	Blending cowpea with wheat flour will reduce the cost of noodles and diversify the use of cowpea. This will create demand for increased cowpea production for enhanced food security and income generation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality cowpea grain, availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing commercial production of cowpea noodles • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies.

	<ul style="list-style-type: none"> • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying cowpea noodles
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product • Lack of credit facilities • limited consumer awareness of value-added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Acquisition of noodle production machines • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively. There is need for the government to facilitate affordable credit to empower farmers take up cowpea agribusiness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs/acre	Not yet estimated
Estimated returns	<ul style="list-style-type: none"> • Reduced loses of excess cowpea grains • Increased income through production and sale cowpea sprouts
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea noodles


VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made cowpea noodles • Cowpea grain can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea noodles production leaflets and manuals</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Require validation	
G: Contacts	
Contacts	<p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.</p>
Lead organization/scientists	<p>KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.</p>
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea noodles production

2.9.10 Cowpea doughnuts

TIMP Name	Cowpea doughnuts
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grain, high postharvest losses and low market price
What is it? (TIMP description)	Cowpea made from composite flour of 40% Cowpea and 60% wheat flour.

	 <p>Cowpea doughnut</p>
Justification	Blending Cowpea with wheat flour will reduce the cost of doughnuts and diversify the use of cowpea. This will create demand for increased cowpea production for enhanced food security and income generation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process, • Field days • Shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); • Availability of high-quality cowpea grain • Availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing of cowpea doughnuts • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying cowpea doughnuts
C: Current situation and future scaling up	
Counties where already promoted, if any	


Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value-added Cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added Cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea grains • Increased income through production and sale cowpea doughnuts
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea doughnuts
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made cowpea doughnuts

	<ul style="list-style-type: none"> Cowpea doughnuts can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea doughnuts production leaflets and manuals</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	<p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.</p>
Lead organization/scientists	<p>KALRO Kuruma R., Ndambuki J., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.</p>
Partner organizations	<ul style="list-style-type: none"> MoALFC (County Governments) CBOs and NGOs Hotels, restaurants, food processing companies Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea doughnut production

2.9.11 Cowpea Cake

TIMP Name	Cowpea Cake
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grain, high postharvest losses and low market price
What is it? (TIMP description)	<p>Cowpea made from composite flour of 40% Cowpea and 60% wheat flour.</p>  <p>Cowpea cake</p>
Justification	Cowpea utilization is limited to boiling. Diversification of cowpea will enhance consumption of cowpea, enhance demand and thus encourage increased production. Adding value to Cowpea grains will also minimize wastage of farm surpluses. The cowpea grains can be processed into flour which is used to make a cake. The cake can be used at domestic level or

	as a source of income.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of cowpeas • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • Innovation platforms • Farmer field and business school • ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); • Availability of high-quality cowpeas, • Availability of quality standards
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties to facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing cowpea cake • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – buying cowpea cake
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value-added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product


	<ul style="list-style-type: none"> • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Not yet estimated
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea grain • Increased income through production and sale cowpea cake
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea cake
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made cowpea cake • Cowpea flour can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea cake production leaflets and manuals</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Ready for upscaling	
G: Contacts	
Contacts	<p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.</p>
Lead organization/scientists	KALRO

	Kuruma R., Ndambuki J.M., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea doughnut production

2.9.12 Cowpea Cookies

TIMP Name	Cowpea Cookies
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grain, high postharvest losses and low market prices
What is it? (TIMP description)	<p>Cowpea cookies made from composite flour of 50% cowpea and 50% wheat flour.</p>  <p>Cowpea cookies</p>
Justification	Blending cowpea with wheat flour will reduce the cost of cookies and diversify the use of cowpea. This will create demand for increased cowpea production for enhanced food security and income generation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality cowpea grains, availability of quality standards. • Farmers should organize themselves into growers' associations

	which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing cowpea cookies • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying cowpea cookies.
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • lack of credit facilities • limited consumer awareness of value added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea grain • Increased income through production and sale cowpea cookies
Gender issues and concerns in development and	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea


dissemination	farming than men <ul style="list-style-type: none"> • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea cookies
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made cowpea cookies • Cowpea cookies can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya Cowpea cookies production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Require validation	
G: Contacts	
Contacts	The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO Kuruma R., Ndambuki J.M., Gathambiri C., WayuaF., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea cookies production

2.9.13 Cowpea Vegetables

TIMP Name	Cowpea Vegetables
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Category (i.e. technology, innovation or management practice)	Innovation	
A: Description of the technology, innovation or management practice		
Problem to be addressed	Limited utilization of cowpea leaves, high postharvest losses and low market prices	
What is it? (TIMP description)	Cowpea vegetables are prepared by packaging the vegetables in a modified atmosphere packaging.	
Justification	Diversification of cowpea food products will enhance consumption of cowpea leaves, enhance demand and thus spur increased production. Cowpea leaves with a fine flavor and texture can be packed for both domestic use and sale.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	<ul style="list-style-type: none">• Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers	
Approaches used in dissemination	<ul style="list-style-type: none">• On-farm experimentation and practical demonstration of preparation process• Field days• Shows• Exhibitions• Farmer Field and Business Schools• Innovation Platforms (IPs)• Farmer exchange visits	
Critical/essential factors for successful promotion	<ul style="list-style-type: none">• Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality cowpea vegetables, availability of quality standards.• Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.	
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none">• Farmers – for activity implementation and promotion• Agricultural extension and advisory services will offer technical advisory services to the farmers.• Counties facilitate the extension staff and provide grants to the farmers.• CIGs play the role of adoption of the technologies through their	

	<p>various groups.</p> <ul style="list-style-type: none"> Processors – packaging of flesh cowpea leaves VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement Consumers – preparing and/or buying flesh packed cowpea leaves
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> Limited awareness of product by farmers and consumers Limited processing technology at the household level. Difficulty in acquiring certificates from regulatory authorities Lack of standards for the product Lack of credit facilities Limited consumer awareness of value added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Awareness creation about the product to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the product Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased income and nutrition from sale and consumption of cowpea flesh packed leaves
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> Women have less access to information, technology and knowledge Women have less access to land that can be used for cowpea farming than men Women and youth have limited access to education, training and extension services than men Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> Women and youth stand to benefit in production, use and sale of cowpea packed leaves
VMG issues and concerns	<ul style="list-style-type: none"> VMGs have less access to agricultural information, technology and


in development and dissemination	<p>knowledge</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and sale locally packaged cowpea leaves • Cowpea leaves can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Cowpea leaves production leaflets and manuals</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	<p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.</p>
Lead organization/scientists	<p>KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., WayuaF., Kirigua V. and Wasilwa L.</p>
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea vegetables production

2.9.14 Cowpea Ball

TIMP Name	Cowpea Ball
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grain, high postharvest losses and low market prices
What is it? (TIMP description)	Cowpea balls is prepared from cow pea flour or dehulled cowpea. The flour is mixed with spices and warm water to form a dough which is rolled to balls. The balls are deep fried, cooled and packed.

	 <p>Cowpea ball</p>
Justification	Diversification of cowpea food products will enhance consumption of cowpea grain, enhance demand and thus spur increased production. Cowpea grain free from damage, weevils and chemical can be used to make balls for both domestic use and sale.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); • Availability of high-quality cowpea grains • Availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing cowpea balls • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying cowpea balls
C: Current situation and future scaling up	


Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea grain • Increased income through production and sale cowpea ball
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea balls
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made cowpea balls • Cowpea balls can be used to make cheap nutritious food products,

	which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya Cowpea balls production leaflets and manuals
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 Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., WayuaF., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for cowpea ball production

2.9.15 Green cowpea pods

TIMP Name	Green cowpea pods
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of green cowpea pod and high postharvest losses
What is it? (TIMP description)	<p>Immature cowpea pods are harvested 16-17 days after flowering, which are then packed in modified atmosphere packaging. They are mostly harvested for export though they can be canned, frozen or cooked as vegetable.</p>  <p>Green pods</p>
Justification	Diversification of cowpea food products will enhance consumption of green cowpea which will enhance demand and thus spur increased production. Green cowpea free from mechanical damage and chemical

	free can be harvested and packed for both domestic use and sale.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process, • Field days • Shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP) • Availability of high-quality cowpea grains • Availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Packhouse– green cowpea packaging • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – purchasing of packaged green cowpea for home consumption
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product


	<ul style="list-style-type: none"> • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess green cowpea • Increased income through production and sale cowpea pods
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	Women and youth stand to benefit in production, use and sale of green cowpea
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally packaged green cowpea • Green cowpea can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Green cowpea pods production leaflets and manuals
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 Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO,

	Kuruma R., Ndambuki J.M., Gathambiri C., Wayua F., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for green cowpea pods production

2.9.16 Dehulled Cowpea

TIMP Name	Dehulled Cowpea
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grain and high postharvest losses
What is it? (TIMP description)	<p>Cowpea cookies made from composite flour of 50% cowpea and 50% wheat flour.</p>  <p>Dehulled Cowpea</p>
Justification	Diversification of cowpea food products will enhance consumption of green cowpea which will enhance demand and thus spur increased production. Dry cowpea free from mechanical damage and chemical free can be harvested, threshed, winnowed, dried and dehulled for both domestic use and sale
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process, • Field days, shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality cowpea grains, availability of quality standards. • Farmers should organize themselves into growers' associations

	which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing of dehulled cowpea • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying dehulled cowpea
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • lack of credit facilities • Limited consumer awareness of value-added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased income and nutrition from sale and consumption of dehulled cowpea
Gender issues and concerns in development and	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge

dissemination	<ul style="list-style-type: none"> • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of dehulled cowpea
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made dehulled cowpea • Dehulled cowpea can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes. • The micro-nutrients in dehulled cowpea are particularly healthy for persons who suffer from gluten intolerance.

E: Case studies/profiles of success stories

Success stories	
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Dehulled cowpea production leaflets and manuals</p>

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 Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., WayuaF., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for dehulled cowpea production

2.9.17 Dried cowpea leaves

TIMP Name	Dried cowpea leaves
Category (i.e. technology,	Innovation

innovation or management practice)	
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea leaves and high postharvest losses
What is it? (TIMP description)	<p>Dried cowpea leaves are prepared by washing the leaves, blanching in salt water for 1 minute and drying the leaves using a solar dryer.</p>  <p>Dried cowpea leaves (source ease foods)</p>
Justification	Diversification of cowpea food products will enhance consumption of cowpea leaves, enhance demand and thus spur increased production. Cowpea leaves with a fine flavor and texture can be dried for both domestic use and sale.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality cowpea leaves, availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their

	<p>various groups.</p> <ul style="list-style-type: none"> Processors – processing dried cowpea leaves VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement Consumers – preparing and/or buying dried cowpea leaves.
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> Limited awareness of product by farmers and consumers Limited processing technology at the household level. Difficulty in acquiring certificates from regulatory authorities Lack of standards for the product lack of credit facilities limited consumer awareness of value-added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Awareness creation about the product to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the product Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> Reduced losses of excess cowpea leaves Increased income through production and sale dried cowpea leaves
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> Women have less access to information, technology and knowledge Women have less access to land that can be used for cowpea farming than men Women and youth have limited access to education, training and extension services than men Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> Women and youth stand to benefit in production, use and sale of dried cowpea leaves
VMG issues and concerns	<ul style="list-style-type: none"> VMGs have less access to agricultural information, technology and


in development and dissemination	<p>knowledge</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made dried cowpea leaves • Dried cowpea leaves can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes. • The micro-nutrients in dried cowpea are particularly healthy for persons who suffer from gluten intolerance.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Kuruma, R.W. <i>et al.</i> (2021). KCEP-CRAL Cowpea Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya</p> <p>Dried cowpea leaves production leaflets and manuals</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	<p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.</p>
Lead organization/scientists	<p>KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., WayuaF., Kirigua V. and Wasilwa L.</p>
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for dried cowpea leaves production

2.9.18 Cowpea weaning food

TIMP Name	Cowpea weaning food
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea grain and high postharvest losses
What is it? (TIMP description)	Cowpea weaning food prepared by dehulling, boiling and supplementing to cereal-based infant foods

	 <p>Cowpea weaning food</p>
Justification	Diversification of cowpea food products will enhance consumption of cowpea, enhance demand and thus spur increased production. Cowpea with a fine flavor and texture can be roasted for both domestic use and sale.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality cowpea grains, availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing cowpea weaning food • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying cowpea weaning food.
C: Current situation and future scaling up	
Counties where already promoted, if any	

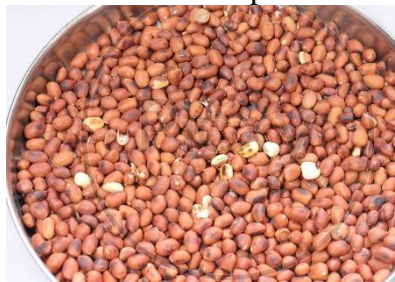
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value-added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea grain • Increased income through production and sale cowpea weaning food
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea weaning food
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made cowpea weaning food • Cowpea weaning food can be used to make cheap nutritious food products, which will lead to enhanced production and consumption

	by VMGs hence bettering their health and incomes.
	<ul style="list-style-type: none"> The micro-nutrients in cowpea weaning food are particularly healthy for children who suffer from gluten intolerance.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Cowpea weaning food production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Require validation
G: Contacts	
Contacts	The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., WayuaF., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> MoALFC (County Governments) CBOs and NGOs (e.g.) Hotels, restaurants, food processing companies Exporters

Research gap

1. Providing data on cost-benefit analysis and gross margins for dried cowpea leaves production

2.9.19 Roasted Cowpea

TIMP Name	Roasted Cowpea
Category (i.e. technology, innovation or management practice)	Tehcnology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of cowpea and poor postharvest handling
What is it? (TIMP description)	<p>Roasted cowpea prepared from mature grain which are soaked in water, washed and boiled until all the water evaporates. Continue roasting until the skin of the cowpea rubs off. Serve as a snack.</p>  <p>Roasted cowpea</p>
Justification	Diversification of cowpea food products will enhance consumption of cowpea, enhance demand and thus spur increased production. Cowpea with a fine flavor and texture can be roasted for both domestic use and sale.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers

Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality cowpea grains, availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing roasted cowpea • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g., KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying roasted cowpea
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Turkana
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value-added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value


	added cowpea products; nutrition education to consumers	
Lessons learnt in upscaling, if any	<ul style="list-style-type: none">• A good value-added product will penetrate the market very fast.	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none">• Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	Not yet determined	
Estimated returns	<ul style="list-style-type: none">• Reduced loses of excess cowpea grains• Increased income through production and sale roasted cowpea	
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none">• Women have less access to information, technology and knowledge• Women have less access to land that can be used for cowpea farming than men• Women and youth have limited access to education, training and extension services than men• Men dominant most decisions at the household and community levels	
Gender related opportunities	<ul style="list-style-type: none">• Women and youth stand to benefit in production, use and sale of roasted cowpea	
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Opportunity to produce, trade in, and consume locally made roasted cowpea• Roasted cowpea can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes.• The micro-nutrients in roasted cowpea are particularly healthy for persons who suffer from gluten intolerance.	
E: Case studies/profiles of success stories		
Success stories		
Application guidelines for users	Roasted cowpea production leaflets and manuals	
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)		Require validation
G: Contacts		
Contacts	The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.	
Lead organization/scientists	KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., WayuaF., Kirigua V. and Wasilwa L.	
Partner organizations	<ul style="list-style-type: none">• MoALFC (County Governments)	

	<ul style="list-style-type: none"> • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters
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Research gap

1. Providing data on cost-benefit analysis and gross margins for roasted cowpea production

2.9.20 Cowpea Hay

TIMP Name	Cowpea Hay
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited livestock feed during dry season
What is it? (TIMP description)	<p>It is the use of dried cowpea crop remains used as forage.</p>  <p>Cowpea Hay</p>
Justification	Conserved hay from harvested cowpea will alleviate the deficit. The hay from cowpea is very nutritious. It can feed a wide range of livestock including beef, dairy and sheep especially feed lotting during dry season.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension agencies • Entrepreneurs • Traders • Animal feed companies
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Shows • Exhibitions • Farmer Field and Business Schools • Innovation Platforms (IPs) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality cowpea, availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process cowpeas into various products; the government should facilitate affordable credit to empower farmers take up cowpea agribusiness.

Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Hay makers • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Consumers(dairy cattle, beef cattle, goats and sheeps)
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be upscaled	Tuura
Challenges in development and dissemination	<ul style="list-style-type: none"> • Limited awareness of product by farmers and consumers • Limited processing technology at the household level. • Difficulty in acquiring certificates from regulatory authorities • Lack of standards for the product • Lack of credit facilities • Limited consumer awareness of value-added cowpea products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare hay • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cowpea products; nutrition education to consumers
Lessons learnt in upscaling, if any	A quality value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers).
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	<ul style="list-style-type: none"> • Reduced losses of excess cowpea • Increased income through production and sale cowpea hay
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for cowpea farming than men • Women have limited access to education, training and extension services than men • Men dominant most decisions at the household and community

	levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of cowpea hays
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and utilized locally made hay • Cowpea hay can be used to make cheap nutritious feed for animals, which will lead to enhanced milk production for VMGs hence bettering their incomes.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Cowpea hay production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Require validation	
G: Contacts	
Contacts	The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO, Kuruma R., Ndambuki J.M., Gathambiri C., WayuaF., Kirigua V. and Wasilwa L.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters


Research gap

1. Providing data on cost-benefit analysis and gross margins for roasted cowpea production

2.5.3 MECHANIZATION OF COWPEA PRODUCTION ACTIVITIES

2.9.21 Power Tiller

TIMP Name	Power tiller
Category:	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • Slow and tedious processes of seedbed preparation, in a commercialized Cowpea commodity • Difficult to prepare a uniform fine tilth seedbed manually • Delayed operation lead to late planting • High cost of manual labour

	<p>A Power tiller is a low powered two-wheeled agricultural implement, also referred to as a walking tractor 8-16hp that can be fitted with a rotary tiller, disk harrow, mouldboard plough, trailer, water pump or chisel at alternate times for easing farm operations. It can complete one hectare per day by one operator in about two hours though the machine could do more with a different operator. This will vary depending on the climatic conditions, soil types, soil moisture content, operator stamina and experience. Fuel consumption is about 15 litres per ha. Though these results may vary with the technical ability of the operator.</p>
<p>Justification</p>	<p>It has multiple uses and other advantages. A Power Tiller can be used in seedbed preparation, sowing seed, planting seed, spraying fertilizer, herbicide and even irrigation. In addition, can also be used for transporting produce. A power Tiller is ideal where the land size is small. Farm sizes less than one hectare may limit manoeuvrability of conventional tractors while manual labour is slow and costly.</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Cowpea farmers and researchers</p>
<p>Approaches used in dissemination</p>	<ul style="list-style-type: none"> • Field Demonstrations • Exhibitions • Agricultural shows (ASK) T • raining
<p>Critical/essential factors for successful promotion</p>	<p>Multiple usage, timeliness, efficiency and low cost</p>
<p>Partners/stakeholders for scaling up and their roles</p>	<ul style="list-style-type: none"> • KALRO, Universities (for information) • Machinery fabricators • NGO supporting farmers for dissemination
<p>C: Current situation and future scaling up</p>	
<p>Counties where already promoted if any</p>	<p>Kitui, Machkos, Makueni, Tharaka Nithi</p>
<p>Counties where TIMP will be up scaled</p>	<p>Turkana</p>
<p>Challenges in dissemination</p>	<ul style="list-style-type: none"> • Lack of facilitation for demonstration • High initial cost for small-scale machines
<p>Suggestions for addressing the challenges</p>	<ul style="list-style-type: none"> • Acquisition of the machines • Facilitation for demonstration • Build capacity through efficient agricultural production to afford the cost
<p>Lessons learned in up scaling if any</p>	<ul style="list-style-type: none"> • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations
<p>Social, environmental, policy and market</p>	<ul style="list-style-type: none"> • Creation of awareness on mechanization

conditions necessary for development and up scaling	<p>importance in agricultural production</p> <ul style="list-style-type: none"> • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 280,000
Estimated returns	KES 180,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crop production activities, therefore the implement will reduce their drudgery of work • Women and youth have limited access credit to purchase the required implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to credit to purchase farm implements such as a wheeled tractor • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (<i>1-ready for upscaling; 2-requires validation; 3-requires further research</i>)	Ready for upscaling
G: Contacts	
Contacts	<p>The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535</p>
Lead organization and scientists	KALRO, Egerton University Nasiremba W,
Partner organizations	Agricultural machines dealers


2.9.22 Wheeled Tractor 50Hp

TIMP Name		Wheeled Tractor 50Hp
Category: Technology		
A: Description of the technology, innovation or management practice		
Problem to be addressed		<ul style="list-style-type: none"> • Slow and tedious processes of seedbed preparation, in a commercialized Cowpea commodity • Difficult to prepare a uniform fine tilth seedbed manually • Delayed operation lead to late planting • High cost of manual labour
	What is it? (TIMP description)	<p>A small sized, a 4 wheeled tractor is a low powered agricultural implement of 40-55hp that can be fitted with a rotary tiller, disk harrow, mouldboard plough, trailer, water pump or chisel at alternate times for easing farm operations. It can complete 4 hectares per day by one operator but can have two operators to run another 8 hours of 4 hectares coming to 8 per day. This will vary depending on the climatic conditions, soil types, soil moisture content and operator experience. Fuel consumption is about 15 litres per ha. Though these results may vary with the technical ability of the operator.</p>
Justification		<p>It has multiple uses and other advantages. A Power Tiller can be used in seedbed preparation soil, sowing seed, planting seed, spraying fertilizer, herbicide and even irrigation. In addition, can also be used for threshing through a power take off device and transporting produce. Farm sizes less than one hectare may limit manoeuvrability of conventional tractors and manual labour is costly and slow.</p>
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP		Cowpea farmers and researchers
Approaches used in dissemination		<ul style="list-style-type: none"> • Field Demonstrations • Exhibitions • Agricultural shows (ASK) T • Training
Critical/essential factors for successful promotion		Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles		<ul style="list-style-type: none"> • KALRO, Universities (for information) • Machinery dealers • NGO supporting farmers for dissemination

C: Current situation and future scaling up	
Counties where already promoted if any	Kitui, Machkos, Makueni, Tharaka Nithi
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of facilitation for demonstration • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Acquisition of the tractors • Lack of facilitation for demonstration • Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 1,780,000,00
Estimated returns	KES 450,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crop production activities, therefore the implement will reduce their drudgery of work • Women and youth have limited access credit to purchase the required implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to credit to purchase farm implements such as a wheeled tractor • 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	<ul style="list-style-type: none"> Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> Demonstrations and training User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI – Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO, Nasirembe W,
Partner organizations	Agricultural machinery dealers

2.9.23 Mouldboard plough

TIMP Name		Mouldboard plough
Category:		Technology
A: Description of the technology, innovation or management practice		
Problem to be addressed		<ul style="list-style-type: none">• Slow and tedious processes of seedbed preparation, in a commercialized Cowpea commodity• Difficult to prepare a uniform fine tilth seedbed manually• Delayed operation lead to late planting• High cost of manual labour
		<p>What is it? (TIMP description)</p> <p>Mouldboard plough is an agricultural implement and is generally considered to be the important tillage implement. Mouldboard ploughs are available for power tiller and tractor operation. A mouldboard plough does four jobs namely a) cutting the furrow slice, b) lifting the furrow slice. C) inverting the furrow slice and d) pulverizing the furrow slice. Ploughing accounts for more traction energy than any other field operation.</p>
Justification		High Efficiency. When well-adjusted, the plough

	automatically seeks the desired depth. It is Versatility. The various models have different features that enable high efficiency in preparation of the land. Weed Control. Pest Control. Improved Soil Health.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea farmers and researchers
Approaches used in dissemination	<ul style="list-style-type: none"> • Field Demonstrations • Exhibitions • Agricultural shows (ASK) • Training
Critical/essential factors for successful promotion	Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO, Universities (for information) • Machinery fabricators • NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui, Machkos, Makueni, Tharaka Nithi
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of facilitation for demonstration • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Acquisition of the machines • Lack of facilitation for demonstration • Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 550,000
Estimated returns	KES 180,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crop production activities, therefore the implement will reduce their drudgery of work • Women and youth have limited access credit to purchase the required implements

	<ul style="list-style-type: none"> • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Employment opportunities exist for youth in operating the implement
Gender related opportunities	
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to credit to purchase farm implements such as a wheeled tractor • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the implement


E: Case studies/profiles of success stories

Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling

G: Contacts

Contacts	The Institute Director, KALRO AMRI – Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	Nasirembe W, KALRO, Egerton University
Partner organizations	Local Fabricators

2.9.24 Harrow


TIMP Name	Harrow
Category: Technology,	
A: Description of the technology, innovation or management practice	

Problem to be addressed	<ul style="list-style-type: none"> • Slow and tedious processes of seedbed preparation, in a commercialized Cowpea commodity • Difficult to prepare a uniform fine tilth seedbed manually • Delayed operation lead to late planting • Low acreage because of lack of manual labour • High cost of manual labour
What is it? (TIMP description)	It is an implement consisting of a heavy frame set with teeth or tines which is dragged over ploughed land to break up clods, remove weeds, and cover seed and is a cultivating tool set with used primarily for breaking up and smoothing the soil in preparation of a seedbed for small sized grain planting.
Justification	Creating of a crumbly layer for planting is tedious. It is not possible to manually protect the soil surface from rapid drying. Improving both the air and water penetrability into soil manually can be too expensive if manually undertaken. Manual operation will reduce microbiological processes in the soil. Manual land harrowing Improving of nutrient availability to plants.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea farmers and researchers
Approaches used in dissemination	<ul style="list-style-type: none"> • Field Demonstrations • Exhibitions • Agricultural shows (ASK) • Training
Critical/essential factors for successful promotion	Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO, Universities (for information) • Machinery fabricators • NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui, Machkos, Makueni, Tharaka Nithi
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of machines • Lack of facilitation for demonstration • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Acquisition of the machines • Lack of facilitation for demonstration • Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Mechanization in agriculture increases

	<p>production</p> <ul style="list-style-type: none">• Mechanization releases labour to alternative requirement areas• Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none">• Creation of awareness on mechanization importance in agricultural production• Include all gender groups in research, and validation.• Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 280,000
Estimated returns	KES 180,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none">• Women perform most of the crop production activities, therefore the implement will reduce their drudgery of work• Women and youth have limited access credit to purchase the required implements• Women and youth have limited access to education, training and extension services than men• Women have less access to agricultural information, technology and knowledge• Employment opportunities exist for youth in operating the implement
Gender related opportunities	
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none">• VMGs have limited access to credit to purchase farm implements such as a wheeled tractor• 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	<ul style="list-style-type: none">• Opportunities exist for unemployed youth in operating the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none">• Demonstrations and training• User manuals
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	

Contacts	The Institute Director, KALRO AMRI – Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO, Nasirembe W.W.
Partner organizations	Local Fabricators

2.9.25 Cowpea Planter

TIMP Name	Cowpea Planter
Category:	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • Slow and tedious processes of seed placement • Difficult to prepare a uniform fine tilth seedbed manually • Delayed operation lead to late planting • High cost of manual labour
What is it? (TIMP description) 	A Cowpea planter is a device used in agriculture that opens furrows meters, sows seed for Cowpea by positioning them in the soil and burying them to a specific depth without forming a ridge along the seed row. The Cowpea planter sows seed at the proper seeding rate and depth, ensuring that the seed is covered by soil and compacted to ensure necessary contact with the soil.
Justification	<ul style="list-style-type: none"> • Manual planting increase the amount of seed used and may require thinning • Fertilizer use is not evenly distributed when manually applied • Cowpea seed is small making planting depth critical and difficult to attain when manually done and seed shallowly planted will germinate with poor yields • Raw planting increases yields, easy to manage weeds and pests, and more importantly timely uniform and low labour requirement,
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea farmers and researchers
Approaches used in dissemination	<ul style="list-style-type: none"> • Field Demonstrations • Exhibitions • Agricultural shows (ASK) • Training
Critical/essential factors for successful promotion	Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO, Universities (for information)

	<ul style="list-style-type: none"> • Machinery fabricators • NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui, Machkos, Makueni, Tharaka Nithi
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of machines • Lack of facilitation for demonstration • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Acquisition of the machines • Lack of facilitation for demonstration • Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 280,000
Estimated returns	KES 180,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crop production activities, therefore the implement will reduce their drudgery of work • Women and youth have limited access credit to purchase the required implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Employment opportunities exist for youth in operating the implement
Gender related opportunities	
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to credit to purchase farm implements such as a wheeled tractor • 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 <ul style="list-style-type: none"> • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI – Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO, Nasiremba W. W.

2.9.26 Motorised Sprayer

TIMP Name	Motorised Sprayer
Category:	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Slow and tedious processes of manual spraying of Cowpea

What is it? (TIMP description)



A motorized **sprayer** is a device used to spray a liquid, where sprayers are commonly used for projection of water, weed killers, crop performance materials, pest maintenance

Nozzle Guide for Band and Directed Spraying					
	Even Flat Fan	Twin Even Flat Fan	Hollow Cone	Full Cone	Disc and Core Cone
Herbicides					
Pre-emerge	Very Good	Good		Good	
Post-emerge Contact	Good	Very Good	Very Good		
Post-emerge Systemic	Very Good	Good			
Fungicides					
Contact	Good		Good		Very Good
Systemic	Very Good				Good
Insecticides					
Contact		Very Good	Very Good		Very Good
Systemic	Very Good				Good
Growth Regulators	Good			Very Good	

chemicals, as well as manufacturing and production line ingredients. In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides, and fertilizers on agricultural crops. Sprayers are man-portable units typically backpacks with spray guns. They are used to control weeds that can harbour insects by use of herbicides, insect pests that can cause diseases by the use of insecticides as well as pesticides. Control of fungal diseases by the use of fungicides. Application of micronutrients on the plants, boron e.g. as well as foliar fertilizers.

Justification

Pests reduce yields up to 98% and are a major menace in agricultural production. Before Cowpea forms a canopy, broad leaved weeds compete with Cowpea seedling for nutrients and light greatly reducing their yield. Manual sprayer are labour intensive and spraying labour is too expensive. It has lower presser reducing its efficiency

B: Assessment of dissemination and scaling up/out approaches

Users of TIMP

Cowpea Farmers and agribusiness entrepreneurs

Approaches used in dissemination

- Field Demonstrations
- Exhibitions
- Agricultural shows (ASK)
- Training

Critical/essential factors for successful promotion

Use by Farmers

Partners/stakeholders for scaling up and their roles

Machinery fabricators
NGO supporting farmers(AGGRA)


C: Current situation and future scaling up

Counties where already promoted if any	Kitui, Machkos, Makueni, Tharaka Nithi
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Relatively High cost for individual small-scale farmer. • Limited awareness of the existence of machine by the farming community.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Encourage group/cooperative ownership • Launch and awareness campaign through demonstrations and trainings
Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. • Good Policy on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Motorized sprayer 55,000 KES per unit
Estimated returns	KES 180,000.00/year
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	<ul style="list-style-type: none"> • Men perform most of the spraying activities, therefore the implement will reduce their work • Women have less access to farm implements such as the motorized sprayer than men • Women and youth have limited access credit to purchase the required chemicals • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to farm implements such as the motorized sprayer than men • VMGs have limited access credit to purchase the required chemicals • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI – Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W,
Partner organizations	Local Fabricators
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Motorized sprayer 55,000 KES per unit
Estimated returns	KES 180,000.00/year
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	Motorized sprayer designed for easy start and operation. Men have been drawn to spraying by the machine. This task was predominantly for women before the introduction of the machine.
Gender related opportunities	Creates employment at production, transportation, processing and distribution
Gender related opportunities	<ul style="list-style-type: none"> • Creates employment especially for youth • Reduces drudgery for women farmers as well as men
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Facilitation to access information • Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	

Contacts	The Institute Director, KALRO AMRI – Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W,
Partner organizations	Local Fabricators

2.5.4 Ripper binder

TIMP Name	Ripper binder
A: Description of the technology, innovation or management practice	
Problems to be addressed	<ul style="list-style-type: none"> • Drudgery • Efficiencies in grain detachment, winnowing, fuel, throughput and output. • Delayed task accomplishment
What is it? (TIMP description) 	<ul style="list-style-type: none"> • The reaper-binder, or binder, is a farm implement that improved upon the simple reaper. • In addition to cutting the small-grain crop, a binder also 'binds' the stems into bundles or sheaves. • These sheaves are usually then 'shocked' into A-shaped conical stooks, resembling small tipis, to allow the grain to dry for several days before being picked up and threshed.
Justification	The cost of labour, inefficiencies in grain detachment, throughput and output makes it necessary for increased productivity.
Counties where Combine Harvester was tested and promoted	Meru, Machakos, Embu, Kitui
Counties where the TIMP will be promoted	Bomet, Kericho and West Pokot
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, seed producers, contractors, machine operators.
Approaches used in development and dissemination	On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, larger plot demonstrations.
Most effective approach	On-farm experimentation and larger plot effect

	demonstrations.
Critical/essential factors for successful promotion	Participatory implementation, stakeholder capacity building, functioning, stakeholder networks and effective extension services.
Partners/stakeholders for scaling up and their respective roles.	Public and private Partners (MoALF&I) ICRISAT, FIPs (Farmer Input Promotion), Farmer Groups, Service provider agencies e.g. micro-finance agencies, banks, agro-vets, processors and manufacturers, aggregators e.g. CARD (Community Action for Rural Development)] and others e.g. NGOs, CBOs, and FBOs
C: Current situation and future scaling up	
Current extent of reach	Nil
Challenges in development and dissemination	<ul style="list-style-type: none"> • Protective clothing • Machine availability • Trained machine operators
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Contracting approach/sharing • Train on machine operation
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Size, Portability, discharge height
Social, environmental, policy and market conditions necessary	Gender inclusiveness in Machine research and development; Capacity building of stakeholders; understanding community culture, preferences, and practices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per hectare production cost KES 2,500/=
Estimated returns	Not yet tried
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Reduced labour intensity in furrowing/broadcasting • Inaccurate threshing • Difficult to start for women
Gender issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the harvesting activities, therefore the implement will reduce their drudgery of work when available • Women have less access to farm implements such as the Ripper binder than men • Women and youth have limited access credit to purchase the required chemicals • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to farm

	<p>implements such as the Ripper binder than men</p> <ul style="list-style-type: none"> • VMGs have limited access credit to purchase the required chemicals • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories	Request from farmers for thresher
Application guidelines for users	Finger millet mechanization production leaflets
F: Status of TIMP Readiness 1. Ready for upscaling; 2. Requires validation; 3. Requires further research	Requires validation
G: Contacts	
Contacts	Engineer Nasirembe, 0733812953
Lead organization and scientists	KALRO, AMRI Katumani Director.amri@kalro.org
Partner organizations	Egerton University

2.5.5 Thresher

TIMP Name	Thresher
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Slow and tedious processes of Manual threshing and winnowing of Cowpea Quality of grain
What is it? (TIMP description)	<p>It is a machine that simultaneously threshes, polishes and winnows Cowpea. A Cowpea thresher is an intermediate technology machine appropriate for Small Holder Farmers, and it is made from locally available materials and services. It is designed to Thresh, and Winnow a variety of leguminous crops like; Cowpeas, Pigeon Peas, Laplap, Simsim, green grams and Soya</p>
Justification	To make Cowpea threshing and winnowing faster, less tedious and more effective. Attract the youth to agribusiness through operation of the machines. Hand threshing and separation is tedious and time consuming while transporting




	before threshing is costly and causes loss of grains
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea Farmers and agribusiness entrepreneurs
Approaches used in dissemination	<ul style="list-style-type: none"> • Field Demonstrations and training • Agricultural shows (ASK) and other exhibitions
Critical/essential factors for successful promotion	Use by Farmers
Partners/stakeholders for scaling up and their roles	Machinery fabricators NGO supporting farmers(AGGRA)
C: Current situation and future scaling up	
Counties where already promoted if any	Meru, Thraka Nthi, Kitui, Kisumu
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> • Relatively High cost for individual small-scale farmer. • Limited awareness of the existence of machine by the farming community.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Encourage group/cooperative ownership • Launch and awareness campaign through demonstrations and trainings
Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. • Good Policy on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cowpea thresher 125,000 KES per unit
Estimated returns	Capacity 500 Kg/ hour, Fuel 1 litre /hr (4-5 bags) Require 2 operators at a time Threshing charges: KES 300 per bag Requires 1 season to return the KES 125,000 purchase price
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	<ul style="list-style-type: none"> • Women perform most of the threshing activities, therefore the implement will reduce their drudgery of work • Women have less access to farm implements such as the thresher than men • Women and youth have limited access credit to purchase the thresher • Women and youth have limited access to

	<p>education, training and extension services than men</p> <ul style="list-style-type: none"> • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to farm implements such as the thresher than men • VMGs have limited access credit to purchase the implement • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories	It has reduced labour for farmers in Tharaka nithi, Kitui, and Kisumu for Cowpea contracted farmers
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Ready for up-scaling
G: Contacts	
Contacts	<p>The Institute Director, KALRO AMRI - Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535</p>
Lead organization and scientists	KALRO, Rachael Kisilu, Nasirembe W Egerton University, Musa Njue and Erick Cheruiyot, , CK Kamau
Partner organizations	Tecsols Ltd - Nakuru

2.5.6 Combine Harvester


TIMP Name	Combine harvester
pigeonA: Description of the technology, innovation or management practice	
Problems to be addressed	<ul style="list-style-type: none"> • Drudgery • Efficiencies in grain detachment, winnowing, fuel, throughput and output. • Delayed task accomplishment

<p>What is it? (TIMP description)</p> 	<ul style="list-style-type: none"> • A combine harvester, is a versatile machine designed to efficiently harvest a variety of grain crops. The name derives from its combining three separate harvesting operations—reaping, threshing, and winnowing—into a single process. • The major components of the machine include threshing, separation and cleaning units. • After being beaten, the grains fall through a concave grid into the cleaning unit which consists of blower set to a speed that only blows out chaff and grain is collected on a receptor
Justification	The cost of labour, inefficiencies in grain detachment, winnowing, fuel, throughput and output makes it necessary for increased productivity.
Counties where Combine Harvester was tested and promoted	Meru, Machakos, Embu, Kitui
Counties where the TIMP will be promoted	Bomet, Kericho and West Pokot
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, seed producers, contractors, machine operators.
Approaches used in development and dissemination	On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, larger plot demonstrations.
Most effective approach	On-farm experimentation and larger plot effect demonstrations.
Critical/essential factors for successful promotion	Participatory implementation, stakeholder capacity building, functioning, stakeholder networks and effective extension services.
Partners/stakeholders for scaling up and their respective roles.	Public and private Partners (MoALF&I) ICRISAT, FIPs (Farmer Input Promotion), , Farmer Groups, Service provider agencies e.g. micro-finance agencies, banks, agro-vets, processors and manufacturers, aggregators e.g. CARD (Community Action for Rural Development)] and others e.g. NGOs, CBOs, and FBOs
C: Current situation and future scaling up	
Current extent of reach	Nil
Challenges in development and dissemination	<ul style="list-style-type: none"> • Protective clothing • Machine availability • Trained machine operators
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Contracting approach/sharing • Train on machine operation

Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Size, Portability, discharge height
Social, environmental, policy and market conditions necessary	Gender inclusiveness in Machine research and development; Capacity building of stakeholders; understanding community culture, preferences, and practices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 2,500/=
Estimated returns	Not yet tried
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women perform most of the harvesting activities, therefore the implement will reduce their drudgery of work when available • Women have less access to farm implements such as the combine harvester than men • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to farm implements such as the combine harvester than men • VMGs have limited access credit to purchase the required chemicals • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories	Request from farmers for thresher
Application guidelines for users	Finger millet mechanization production leaflets
F: Status of TIMP Readiness 1. Ready for upscaling; 2. Requires validation; 3. Requires further research	Requires validation
G: Contacts	
Contacts	The Institute Director, KALRO AMRI - Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535

Lead organization and scientists	KALRO, Engineer Nasirembe
Partner organizations	Egerton University

2.5.7 Grader

TIMP Name	Grader
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • Late harvesting • Untimely harvesting • High cost of labour • Poor quality of produce due to injury • Loses due to part harvesting when workers get fatigued and some harvested Cowpeas are left on the farm
What is it? (TIMP description) 	<p>A Cowpea grader is a machine that has PVC rollers that rotate the Cowpeas for workers to do quality inspection, and finally grade on three to six sizes. Either the bag closing device weighing system can help you do packing directly. With conveyor at the bottom of the hopper, this machine is automatic feeding and can carry a large capacity.</p> <p>Roller inspection tables- roller conveyor provides an efficient and affordable way to keep your product constantly rotating when manual inspection is required.</p> <p>Variable speed- Variable-speed operation can be achieved either by mechanical or electrical adjustment.</p> <p>Discharging Conveyors- Gentle and durable belts can carry your product to either side of the Sizer. End with a Bag closing device or slope exit as needed.</p>
Justification	<ul style="list-style-type: none"> • Manual Cowpea grading takes a long time to grade a unit measure of Cowpea normally 25kg and may delay till the Cowpeas start rotting. • Manual grading is labour dependency which is relatively expensive • A part from lack of labour grading cost is saved by at least 60 percent
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cowpea Farmers and agribusiness entrepreneurs
Approaches used in dissemination	Field Demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Use by Farmers

Partners/stakeholders for scaling up and their roles	Machinery fabricators NGO supporting farmers(AGGRA)
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui, Machkos, Makueni, Tharaka Nithi
Counties where TIMP will be up scaled	Turkana
Challenges in dissemination	<ul style="list-style-type: none"> Relatively High cost for individual small-scale farmer. Limited awareness of the existence of machine by the farming community.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Encourage group/cooperative ownership Launch and awareness campaign through demonstrations and trainings
Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. Good Policy on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cowpea thresher 125,000 KES per unit
Estimated returns	Capacity 500 Kg/ hour, Fuel 1 litre /hr (4-5 bags) Requires 3 operators at a time Harvesting charges: KES 300 per bag Requires 1 season to return the KES 125,000 purchase price
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	Cowpea Thresher designed for easy start and operation. Men have been drawn to Cowpea threshing by the machine. This task was predominantly for women before the introduction of the machine.
Gender related opportunities	Creates employment at production, transportation, processing and distribution
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet
Estimated returns	Not yet
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women perform most of the grading activities, therefore the implement will reduce their drudgery of work when available Women have less access to farm implements such as the grader than men Women and youth have limited access to education, training and extension services than men Women have less access to agricultural

	information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to farm implements such as the grader than men • VMGs have limited access credit to purchase the required chemicals • 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	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Institute Director, KALRO AMRI - Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University, Nasiremba W,
Partner organizations	Local Fabricators
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Training on local use and transportation will make it more usable. • Thresher is affordable and could help VMGs exploit
VMG related opportunities	Can create employment for VMG at local level
G: Contacts	
Contacts	The Institute Director, KALRO AMRI - Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO, Nasiremba W Egerton University,
Partner organizations	Tecsols Ltd - Nakuru

2.5.8 AGRICULTURAL BUSINESS AND MARKETING

2.9.27 Smart model for marketing

TIMP Name	Smart Model for Marketing
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Production approach that neglects markets leading to poor farmer-market linkages of cowpeas.
What is it? (TIMP description)	Smart marketing model has seven steps (smart skills) for linking farmers to markets through getting organized, identifying products and organizing groups, collecting information for the business plan, building and implementing a business plan, marketing as a group, reviewing agroenterprise performance and scaling up.
Justification	Market failures or missing markets have led to disorganization in cowpeas market-oriented production. Due to the disorganization in market-oriented production of cowpeas, smallholder farmers have limited market access and linkages leading to loss in cowpea production. Therefore, there is need to build smallholder farmers' skills for guiding them on how to use the marketing approach
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, processing industries, Extension, NGOs, Research institutions
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings, • Electronic media (radio, TV programmes) • Social media (WhatsApp, Facebook, twitter, apps), • Group approach • Field days • Cowpea value chain innovation platform
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Organization of the extension services • Acceptance of smallholder farmers to form production organizations • Investments in the production of quality tradable volumes • Acceptance of the cowpeas varieties by consumers • Adaptability of the cowpeas varieties • Availability of storage infrastructure and transport
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Formation of production groups, investments in cowpeas production • County extension staff - Organization of farmers and technical service delivery • NGOs – Organization of farmers and service delivery • Private sector (local traders and exporters) – Support in input services and providing markets for the cowpeas production • Research institutions – Availing improved seeds, backstopping

C: Current situation and future scaling up	
Counties where already promoted if any	Machakos, Kitui
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the cowpeas varieties • Group dynamics • Limited availability of improved cowpea variety seeds • Weak or non-existent stakeholder innovation platforms • Consumer unacceptance on the new varieties • Low prices of the cowpeas variety products • Bad weather • Variable quality
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of production clusters • Small-scale farming – allocation of more land to cowpeas production and aggregation of production to assume large scale-farming • Inadequate information to stakeholders on the cowpeas varieties – Use of promotion channels for instance media and field days • Group dynamics – Capacity building on the group dynamics and management • Availability of seeds of the improved varieties – Engagement with KSU and other seed companies. Capacity building of farmers on seed production • Weak or non-existent stakeholder innovation platforms – Formation of innovation platforms. Capacity building stakeholders on elements of innovation platforms • Consumer unacceptance on the new varieties – Promotion of new cowpeas varieties through field days. • Low prices of the cowpeas varieties – Value addition, producer organization, managing costs in production, capacity building on farming as a business • Poor and inconsistent product quality – Enhancing adoption of Cowpeas TIMPs • Level of policy support – Use of National agricultural strategies. Lobbying for the County support in policy options
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • High market competition with other cowpeas varieties • Performance of the marketing model in terms of profitability • Informed plan for upscaling the marketing model
Social, environmental, policy and market conditions necessary for	<ul style="list-style-type: none"> • Social conditions – acceptability by the farmers, group dynamics, cultures, social problems

development and up-scaling	<ul style="list-style-type: none"> • Environmental conditions – Enhancing natural resource management to increase production • Policy conditions – Policy support in extension, inputs, prices, production organizations (cooperatives), infrastructure, investment environment
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<p>Farmers should produce each kg of cowpeas grain at Ksh 30-35 per kg</p> <p>Land preparation (oxen) = 1,500 (11%)</p> <p>Certified seed (8kg/acre) = 1,600 (12%)</p> <p>Fertilizer/Manure application = 3,000 (23%)</p> <p>Labour costs for all activities = 5,900 (45%)</p> <p>Pesticides and fungicides = 360 (2%)</p> <p>Marketing costs = 390 (3%)</p> <p>Total variable costs = KES.13,140</p>
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67, giving a gross margin of between KES. 7,000 and 42,000 from grain production; and KES. 218,000 – 260,000 from vegetable production
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Development and dissemination – Different acceptance characteristics by youth, females and males. Gender roles in the production of cowpeas. Availability of technologies for pre-harvesting, harvesting and post-harvesting • Adoption and scaling – Different acceptance characteristics, Gender inclusion in the formation of producer organizations.
Gender related opportunities	<ul style="list-style-type: none"> • Production opportunities by youth, females and males in the production of cowpeas. • Emerging mechanization in the value chain • Generation of income by youth female and male
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Development and dissemination – Limited involvement of VMGs in the market linking models • Adoption and scaling up - Limited access to seed and information on new varieties and production techniques
VMG related opportunities	<ul style="list-style-type: none"> • Production opportunities – Available machines for labour reduction for the VMGs • Income generation using farmer-market linking models • Access to inputs and markets through linkages and producer organization
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> • Farmers get organized in marketing their crop production • With understanding of markets and marketing, farmers have improved access to markets leading to increased income
Application guidelines for users	Training factsheets, manuals and power point slides are available

F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	The marketing model requires validation
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.W.
Partner organizations	

GAPS

Further research

- Efficiency evaluation of seven steps marketing model
- Equity distribution among the producers
- Productivity levels among the smallholder farmers
- Farmer accessibility to production inputs

2.9.28 SWOT analysis - Business Strengths, Weaknesses, Opportunities and Threats

TIMP Name	SWOT analysis - Business Strengths, Weaknesses, Opportunities and Threats
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Diversification with no identified products for markets, nor determining comparative advantage to address available opportunities leading to low production and market accessibility
What is it? (TIMP description)	SWOT analysis is a tool for identifying farms strengths and weaknesses and selecting from available opportunities in agricultural production and marketing. Used for the identification of production options, buyers and marketing channels. Similar to other businesses, SWOT can help a farmer to achieve opportunities that greatly match the business activity strengths, attain opportunities by overcoming weaknesses, reduce the business activity vulnerability to threats by using strengths and avoid making the business activity more susceptible to threats by preventing weaknesses
Justification	There are many opportunities in cowpea production. For the farmers to transform from subsistence-oriented production to market-oriented production there is need for the identification of the production and marketing opportunities with the evaluation of own strengths and weaknesses as well as existing significant threats.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders and processors
Approaches to be used in dissemination	Trainings, factsheets, manuals
Critical/essential factors for	<ul style="list-style-type: none"> • Education levels of the farmers and investors in cowpeas

successful promotion	<ul style="list-style-type: none"> production Levels of experiences in cowpeas production Availability of information on cowpeas production and marketing Levels of competition among the cowpeas
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> Farmers – Demanding opportunities County extension staff - Capacity building NGOs – Capacity building Private sector (local traders and exporters) – Demanding opportunities Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination -	<ul style="list-style-type: none"> Disorganization and scattered farmers Small-scale farming Inadequate information to stakeholders on the cowpeas production and marketing Limited assessments strengths, weaknesses and threats in cowpeas production and marketing Levels of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Disorganization and scattered farmers – Formation of production clusters Small-scale farming – allocation of more land to cowpeas production and aggregation of production to assume large scale-farming Inadequate information to stakeholders on the cowpeas production – Developing information hub Levels of strengths, weaknesses and threats in cowpeas production and marketing – Sensitization of stakeholders on how to identify and assess strengths, weaknesses and threats Level of policy support – support in extension services
Lessons learned in up scaling if any	<ul style="list-style-type: none"> None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> Social conditions – Conflicts with subsistence-oriented production Environmental conditions – Opportunities degrading natural resource management Policy conditions – Policy support in opportunities selected
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<p>Farmers produce each kg of cowpeas grain at Ksh 30-35 per kg</p> <p>Land preparation (oxen) = 1,500 (11%)</p> <p>Certified seed (8kg/acre) = 1,600 (12%)</p> <p>Fertilizer/Manure application = 3,000 (23%)</p> <p>Labour costs for all activities = 5,900 (45%)</p> <p>Pesticides and fungicides = 360 (2%)</p>

	Marketing costs = 390 (3%) Total variable costs = KES.13,140
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67, giving a gross margin of between KES.7,000 and 42,000 from grain production; and KES.218,000 – 260,000 from vegetable production, based on the variety grown following SWOT analysis
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> Inadequate representation of women and youth when during the SWOT analysis exercise
Gender related opportunities	<ul style="list-style-type: none"> Women and youth have an opportunity to participate in SWOT analysis exercise
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs also have limited participation in SWOT analysis exercise Due to their social status VMGs are often excluded from decision making in development and dissemination activities
VMG related opportunities	<ul style="list-style-type: none"> Opportunities for those recovering from drugs and HIV to participate in SWOT analysis exercise
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	SWOT matrix is ready for up scaling
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.
Partner organizations	

GAPS

Further research

- Software for running the SWOT matrix
- Efficiency in identifying the opportunities
- Performance of the opportunities

2.9.29 Products-Markets Matrix

TIMP Name	Products-markets matrix
Category (i.e. technology, innovation or management)	Management practice

practice)	
A: Description of the technology, innovation or management practice	
Problem addressed	Diversification with no identified products for specific markets leading to low prices and market accessibility
What is it? (TIMP description)	Products-markets matrix is a tool for identifying and selecting opportunities in agricultural production and marketing. Used for the identification of production options, buyers and marketing channels. Similar to other businesses, product-markets matrix can help a farmer to achieve opportunities that greatly match the business activity strengths, attain opportunities by overcoming risks.
Justification	There are many opportunities in cowpea production. For the farmers to transform from subsistence-oriented production to market-oriented production by producing for specific markets, hence need for the identification of the levels of risks.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders and processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Trainings, • Reference materials (factsheets, manuals)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Education levels of the farmers and investors in cowpea production • Levels of experiences in cowpeas production • Availability of information on cowpea varieties, production practices and marketing • Differentiated markets for cowpea products and varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Demanding opportunities • County extension staff - Capacity building • NGOs – Capacity building • Private sector (local traders and exporters) – Demanding opportunities • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Limited access to improved and adapted cowpea varieties • Inadequate information to stakeholders on the cowpeas production and marketing • Levels of risks in cowpeas production and marketing • Levels of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of production clusters • Small-scale farming – allocation of more land to cowpeas production and aggregation of production to assume large

	<p>scale-farming</p> <ul style="list-style-type: none"> • Limited access to improved varieties – Partnership and contracts with seed merchants and capacity building • Inadequate information to stakeholders on the cowpeas production – Developing information hub and cowpea value chain innovation platform • Levels of risks in production and marketing – Sensitization of stakeholders the challenges. • Level of policy support – support in extension services
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Conflicts with subsistence-oriented production • Environmental conditions – Opportunities degrading natural resource management • Policy conditions – Policy support in opportunities selected
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<p>Farmers produce each kg of cowpeas grain at Ksh 30-35 per kg</p> <p>Land preparation (oxen) = 1,500 (11%)</p> <p>Certified seed (8kg/acre) = 1,600 (12%)</p> <p>Fertilizer/Manure application = 3,000 (23%)</p> <p>Labour costs for all activities = 5,900 (45%)</p> <p>Pesticides and fungicides = 360 (2%)</p> <p>Marketing costs = 390 (3%)</p> <p>Total variable costs = KES.13,140</p>
Estimated returns	<p>The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67, giving a gross margin of between KES.7,000 and 42,000 from grain production; and KES.218,000 – 260,000 from vegetable production, based on the variety grown market identification</p>
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of women and youth when identifying and selecting opportunities using the Products-markets matrix
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth have an opportunity to participate in identifying and selecting opportunities using the Products-markets matrix if they are willing
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs also have limited participation in identifying and selecting opportunities using the Products-markets matrix • Due to their social status VMGs are often excluded from decision making in development and dissemination activities
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for those recovering from drugs and HIV to participate in identifying and selecting opportunities using the Products-markets matrix

E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Products-Markets matrix is ready for up scaling
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.W
Partner organizations	

GAPS

Further research

- Software for running the products-markets matrix
- Reduction in risk levels
- Sustainability of markets

2.9.30 Pairwise matrix

TIMP Name	Pairwise matrix
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Diversification with no identified comparative advantage for products targeting markets leading to low market accessibility and postharvest losses
What is it? (TIMP description)	Pairwise matrix is a tool for a participatory identification, ranking and analysis of the problems and opportunities in development, agricultural production and marketing.
Justification	There are many problems and opportunities in cowpea production. For the farmers to transform from subsistence-oriented production to market-oriented production, there is need for the identification of the production problems and marketing opportunities in a structured process that is easy to replicate.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	Trainings, factsheets, manuals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Education levels of the farmers and investors in cowpeas production • Levels of experiences in cowpea production • Availability of information on cowpea production and

	<ul style="list-style-type: none"> marketing Levels of competition among the cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> Farmers – Demanding opportunities County extension staff - Capacity building NGOs – Capacity building Private sector (local traders and exporters) – Demanding opportunities Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination -	<ul style="list-style-type: none"> Disorganization and scattered farmers Small-scale farming Inadequate information to stakeholders on the cowpea production and marketing Education levels Limited market opportunities Levels of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Disorganization and scattered farmers – Formation of production clusters Small-scale farming – allocation of more land to cowpea production and aggregation of production to assume large scale-farming Inadequate information to stakeholders on the cowpea production – Developing information hub Limited market opportunities – Innovations Level of policy support – support in extension services
Lessons learned in up scaling if any	<ul style="list-style-type: none"> None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> Social conditions – Conflicts with subsistence-oriented production Environmental conditions – Opportunities degrading natural resource management Policy conditions – Policy support in opportunities selected
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<p>Farmers produce each kg of cowpeas grain at Ksh 30-35 per kg</p> <p>Land preparation (oxen) = 1,500 (11%)</p> <p>Certified seed (8kg/acre) = 1,600 (12%)</p> <p>Fertilizer/Manure application = 3,000 (23%)</p> <p>Labour costs for all activities = 5,900 (45%)</p> <p>Pesticides and fungicides = 360 (2%)</p> <p>Marketing costs = 390 (3%)</p> <p>Total variable costs = KES.13,140</p>
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67, giving a gross margin of between KES. 7,000 and 42,000 from grain production; and KES.

	218,000 – 260,000 from vegetable production, based on the opportunities identified in the pairwise matrix
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> Inadequate representation of women and youth when identifying and selecting opportunities using the Pairwise matrix is a tool
Gender related opportunities	<ul style="list-style-type: none"> Women and youth have an opportunity to participate in identifying and selecting opportunities using the Pairwise matrix is a tool if they are willing
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs also have limited participation in identifying and selecting opportunities using the Pairwise matrix is a tool Due to their social status VMGs are often excluded from decision making in development and dissemination activities
VMG related opportunities	<ul style="list-style-type: none"> Opportunities for those recovering from drugs and HIV to participate in identifying and selecting opportunities using the Pairwise matrix is a tool
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Pairwise matrix is ready for up scaling
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.W
Partner organizations	

GAPS

Further research

- Software for running pairwise matrix
- Efficiency in identifying the opportunities
- Performance of the opportunities

2.9.31 Farm budgeting, Record keeping, Break-even and Gross margin analysis

TIMP Name	Farm budgeting, Record keeping, Break-even and Gross margin analysis
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Difficulties for the farmers to forward-plan as well as know how much they spent and how much income was earned from their cowpeas production.

What is it? (TIMP description)	A budget is a formal plan for carrying out business activities in the future. It shows the process of carrying out an activity and the end result. Budgeting is the planning process or the development of a plan of action (budget). Record keeping is the art of collecting useful pieces of data or information on the happenings of a particular undertaking, with the view of processing it in the future (for example, analysing sales and costs and calculating profits). Break-even and gross margin are used are used to compare costs and returns and therefore profit.
Justification	An effective farm budgeting process begins with the definition of production programme. This is followed by specifying and estimating the inputs that are needed for the production programme. Without good farm records, it becomes difficult for farmers to identify problem areas and know whether their businesses are generating profit or not. Therefore, record keeping is an important activity that is necessary for operating farm businesses successfully.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	Trainings, factsheets, manuals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Production programme • Availability of data on quantities of inputs requirements, costs, outputs and value
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Defining production programme • County extension staff - Capacity building • NGOs – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the cowpeas production and marketing • Defining production programmes of cowpeas • Levels of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of production clusters • Small-scale farming – allocation of more land to cowpeas production and aggregation of production to assume large scale-farming • Inadequate information to stakeholders on the cowpeas production – Developing information hub • Defining production programmes of cowpeas • Level of policy support – support in extension services

Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Conflicts with subsistence-oriented production • Environmental conditions – Opportunities degrading natural resource management • Policy conditions – Policy support in opportunities selected
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<p>Farmers produce each kg of cowpeas grain at Ksh 30-35 per kg</p> <p>Land preparation (oxen) = 1,500 (11%)</p> <p>Certified seed (8kg/acre) = 1,600 (12%)</p> <p>Fertilizer/Manure application = 3,000 (23%)</p> <p>Labour costs for all activities = 5,900 (45%)</p> <p>Pesticides and fungicides = 360 (2%)</p> <p>Marketing costs = 390 (3%)</p> <p>Total variable costs = KES.13,140</p>
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67, giving a gross margin of between KES. 7,000 and 42,000 from grain production; and KES. 218,000 – 260,000 from vegetable production, based on the production decisions adopted following farm budgeting and gross margin analysis
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • High illiteracy levels of women leading to lack of record keeping and poor record keeping
Gender related opportunities	<ul style="list-style-type: none"> • Being a high value crop, opportunities exist for youth since they are highly literate and can be able to keep good records
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Some VMGs like the youths are illiterate hence cannot keep good records • VMGs like the elderly and women are illiterate hence cannot keep since they cannot write
VMG related opportunities	<ul style="list-style-type: none"> • Those youths recovering from drugs and HIVs have an opportunity to venture in this enterprise since they can be able to keep good farm record.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Budget templates are ready for up-scaling
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.
Partner organizations	

GAPS

Further research

- Software for running the budgets
- Profitable opportunities
- Performance of budgets

2.9.32 Market Research

TIMP Name	Market Research
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Market information asymmetry is a major constraint to market access.
What is it? (TIMP description)	Market research involves market visits and data collection on the type of product required, demand, minimum volume purchased, quality, packaging requirements, frequency of delivery, purchase price, means of payment and willing to buy from local farmers.
Justification	Smallholder farmers in many remote areas do not understand how the market works or why prices fluctuate. They have little or no information on market conditions, prices and quality of goods; they are not organized collectively; and they have no experience of market negotiation and little appreciation of their capacity to influence the terms and conditions upon which they enter the market. Difficult market access restricts opportunities for income generation. Farmer market research provides relevant data to help solve marketing challenges that farmers most likely face in their farm businesses.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension, NGOs, Researchers.
Approaches to be used in dissemination	Trainings, Market visits Reference materials (factsheets, manuals)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Organization of farmers • Formation of market research group or market opportunity group • Availability of facilitators • Availability of many traders • Production volume and quality
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Formation of market opportunity group • County extension staff - Facilitators • NGOs – Facilitators • Private sector (local traders and exporters) – Buyers • Research institutions – Facilitators
C: Current situation and future scaling up	
Counties where already promoted if	None

any	
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Limited formation of market opportunity group • Limited available of market information • Levels of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organization • Small-scale farming – allocation of more land to cowpea production and aggregation of production to assume large scale-farming • Formation of market opportunity group • Availability of information • Levels of policy support
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Conflicts with subsistence-oriented production • Environmental conditions – Over-use of cultivated land due to over-production of cowpeas • Policy conditions – Policy support in market opportunity groups
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<p>Farmers produce each kg of cowpeas grain at Ksh 30-35 per kg</p> <p>Land preparation (oxen) = 1,500 (11%)</p> <p>Certified seed (8kg/acre) = 1,600 (12%)</p> <p>Fertilizer/Manure application = 3,000 (23%)</p> <p>Labour costs for all activities = 5,900 (45%)</p> <p>Pesticides and fungicides = 360 (2%)</p> <p>Marketing costs = 390 (3%)</p> <p>Total variable costs = KES.13,140</p>
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67, giving a gross margin of between KES. 7,000 and 42,000 from grain production; and KES. 218,000 – 260,000 from vegetable production, based on the variety grown following market research
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of women and youth when conducting market research • Due to their tripple roles women have no time to go to far market to conduct market research
Gender related opportunities	<ul style="list-style-type: none"> • Women have an opportunity to participate in in market research if they are willing • Opportunities exist for youth in conducting market research
VMG issues and concerns in	<ul style="list-style-type: none"> • VMGs also have limited participation in market

development and dissemination, adoption and scaling up	<p>research</p> <ul style="list-style-type: none"> • Due to their social status VMGs are often excluded from decision making in development and dissemination activities
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for those recovering from drugs and HIV to participate in market research • Formation of and participation in groups
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Guidelines on market research are ready for up-scaling
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.W.
Partner organizations	

GAPS

Further research

- The strength of market linkage through market research
- Equity distribution in sales and income

2.9.33 Forming Producer Organizations

TIMP Name	Forming Producer Organizations
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Smallholders working alone typically lack the production volume and the bargaining power to command on-time delivery of agricultural inputs at reasonable prices.
What is it? (TIMP description)	Producer organization is a group of producers formed with an objective of accessing markets and reducing market failures. It is a legal entity established to bring farmers together to benefit from marketing.
Justification	The rural poor are constrained by lack of information about markets, lack of business and negotiating experience, and lack of a collective organization which can give them the power they require to interact on equal terms with other, generally larger and stronger, market intermediaries. Cultural and social distance, and discrimination, may also be factors that at least

	partly exclude the poor from markets. Therefore, formation of producer organizations would reduce these constraints.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders and processors
Approaches to be used in dissemination	Trainings, Exchange visits Reference materials (factsheets, manuals)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of County policies • Willingness of farmers to participate in PO • Availability of targeted markets
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Members of producer organization • County extension staff - Capacity building • NGOs – Capacity building • Private sector (local traders and exporters) – Targeted markets • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the cowpeas production and marketing • Group dynamics • Levels of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of production organizations and capacity building on establishment of producer organizations • Small-scale farming – allocation of more land to cowpeas production and aggregation of production to assume large scale-farming • Inadequate information to stakeholders on the cowpeas production and marketing – Capacity building on sources of information. • Group dynamics – Capacity building • Level of policy support – support in extension services
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Conflicts with subsistence-oriented production • Environmental conditions – Degradation of natural resources due to over-production • Policy conditions – Policies supporting formation and functioning of producer organizations • Market conditions – Existing demand
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Farmers produce each kg of cowpeas grain at Ksh 30-35 per

	kg Land preparation (oxen) = 1,500 (11%) Certified seed (8kg/acre) = 1,600 (12%) Fertilizer/Manure application = 3,000 (23%) Labour costs for all activities = 5,900 (45%) Pesticides and fungicides = 360 (2%) Marketing costs = 390 (3%) Total variable costs = KES.13,140
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67, giving a gross margin of between KES. 7,000 and 42,000 from grain production; and KES. 218,000 – 260,000 from vegetable production, based on the varieties identified in the producer organizations
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Women are widely discriminated in rural producer organizations • Women also have limited participation and influence in rural producer organizations • Socio-cultural norms may limit women's participation and leadership in groups • Women's double and triple roles means they may not have time to participate • Women's status, age, wealth level may influence participation • Limited access to assets, resources and services, required to join producer groups • In some cultures, women may not be able to travel away from their homes to producer group meetings, without permission • Strict rules of entry and requirements of producers' organizations may limit women participation
Gender related opportunities	<ul style="list-style-type: none"> • Men and youth stand to benefit with higher profit margins through collective bargaining during marketing
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs are widely discriminated in rural producer organizations • VMGs also have limited participation and influence in rural producer organizations • Limited access to assets, resources and services, required to join producer groups
VMG related opportunities	<ul style="list-style-type: none"> • 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	None
Application guidelines for users	Training factsheets, manuals and power point slides are

	available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	The guidelines for the formation of producer organizations are ready for up-scaling
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.W.
Partner organizations	

GAPS

Further research

- Performance of producer organizations
- Production efficiency in cowpeas production due to the formation of producer organizations
- Equity distribution in income

2.9.34 Contract farming

TIMP Name	Contract farming
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Markets failure, limited access to credit in driving cowpea production and lack of guaranteed markets for produce has led to low production
What is it? (TIMP description)	Contract farming involves private companies extending lines of credit to producers in the form of farming inputs and technical assistance. Under contract farming terms, contractors commit themselves to buy the entire product contracted out to producers at an agreed price. On the other hand, producers provide labour and manage the contracted farming activity
Justification	Without contract farming, smallholder farmers face poor market access for the cowpea production. Contract farming is a contractual arrangement between producers and buyers of a farm product. The contract can be either 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 intermediation, 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.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Trainings, • Cowpea value chain innovation platform • Reference material (factsheets, manuals)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of willing farmers • Availability of traders • Competitiveness of Cowpea varieties
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Contract party and beneficiaries • County extension staff - Capacity building • NGOs – Capacity building • Private sector (local traders and exporters) – Contract party and beneficiaries • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Turkana
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on contract farming • Levels of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of production clusters • Small-scale farming – allocation of more land to cowpeas production and aggregation of production to assume large scale-farming • Inadequate information to stakeholders on the cowpeas production – Developing information hub • Inadequate information to stakeholders on contract farming – Capacity building • Level of policy support – support in extension services
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Conflicts with subsistence-oriented production • Environmental conditions – Input support in the contract to improve natural resource management • Policy conditions – Policy support in opportunities selected
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<p>Farmers produce each kg of cowpeas grain at Ksh 30-35 per kg</p> <p>Land preparation (oxen) = 1,500 (11%)</p> <p>Certified seed (8kg/acre) = 1,600 (12%)</p> <p>Fertilizer/Manure application = 3,000 (23%)</p>

	<p>Labour costs for all activities = 5,900 (45%)</p> <p>Pesticides and fungicides = 360 (2%)</p> <p>Marketing costs = 390 (3%)</p> <p>Total variable costs = KES.13,140</p>
Estimated returns	The estimated returns at farm gate price are negotiated at the beginning of the season and can range between Ksh 60-67, giving a gross margin of between KES.7,000 and 42,000 from grain production; and KES.218,000 – 260,000 from vegetable production
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Women have less access to knowledge and information on contract farming than men • Women have less access to land for farming than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth 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	<ul style="list-style-type: none"> • VMGs have less access to knowledge and information on contract farming than men • VMGs have less access to land for farming than men
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth 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	<ul style="list-style-type: none"> • Increased income • Increased production • Efficient use of resources
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Contract farming requires further research
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.W..
Partner organizations	

GAPS

Further research

- Performance of contracted farming in terms of productivity, sales and profit
- Equity distribution
- Improvement in skill and information delivery

2.9.35 Internet marketing

TIMP Name	Internet Marketing
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Poor market access due to structural, skills and market information constraints
What is it? (TIMP description)	Internet marketing refers to the strategies and tools used to market products and services online and through other digital means. These can include a variety of online platforms, tools, and content delivery systems
Justification	Internet marketing is increasingly becoming mandatory for businesses of all types. This high adaptability of internet marketing is an important benefit that businesses can take advantage of to provide their consumers with the best shopping experience. Consumers use a variety of online methods for finding, researching, and eventually making purchasing decisions. Internet marketing reduces costs.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders and processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Trainings, • Social media • Reference materials (factsheets, manuals)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Education levels of the farmers and investors in cowpeas production • Levels of experiences in cowpea production • Availability of information on cowpeas production and marketing • Levels of competition among the cowpea
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Sellers of cowpea production • County extension staff - Capacity building • NGOs – Capacity building • Private sector (local traders and exporters) – Buyers of cowpeas • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Counties in semi-arid areas where cowpea production is suitable
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Limited digital skills of farmers and access to internet enabled gadgets • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the cowpeas production and marketing • Internet connectivity

	<ul style="list-style-type: none"> • Levels of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Limited digital skills of farmers and access to internet enabled gadgets – Contracts with local internet bureaus/cyber cafés • Disorganization and scattered farmers – Formation of production organizations • Small-scale farming – allocation of more land to cowpeas production and aggregation of production to assume large scale-farming • Inadequate information to stakeholders on the cowpeas production – Developing information hub • Internet connectivity – Information hub • Level of policy support – support in extension services
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Conflicts between subsistence-oriented production and commercial-oriented production • Environmental conditions – None • Policy conditions – Policy supporting information hub
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<p>Farmers produce each kg of cowpeas grain at Ksh 30-35 per kg</p> <p>Land preparation (oxen) = 1,500 (11%)</p> <p>Certified seed (8kg/acre) = 1,600 (12%)</p> <p>Fertilizer/Manure application = 3,000 (23%)</p> <p>Labour costs for all activities = 5,900 (45%)</p> <p>Pesticides and fungicides = 360 (2%)</p> <p>Marketing costs = 890 (3-5%)</p> <p>Total variable costs = KES.13,640</p>
Estimated returns	The estimated returns for the online marketing could range between KES 45-67, based on volumes and price negotiated, giving a gross margin of between KES. 7,000 and 42,000 from grain production; and KES. 218,000 – 260,000 from vegetable production, depending on the distance where delivery is done
Gender issues and concerns in development and dissemination, adoption and scaling	<p>Women have less access to the required tools such as phones and computer than men</p> <p>Women are more illiterate and therefore cannot use the ICTs compared with men</p>
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
VMG issues and concerns in development and dissemination, adoption and scaling up	<p>VMGs have less access to the required tools such as phones and computer than men</p> <p>VMGs are more illiterate and therefore cannot use the ICTs compared with men</p>
VMG 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

E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Turkana
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Internet marketing requires validation
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.W.
Partner organizations	

GAPS

Further research

- Levels of digital skills by farmers
- Performance of the internet marketing in terms of productivity, sales and profitability

2.5.9 AGRICULTURAL POLICY OPTIONS

2.5.10 Agricultural policy framework

TIMP Name	Agricultural policy framework
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Agricultural policies in Kenya have been developed around the main objectives of increasing productivity and income growth. However, there is failure of agricultural policy making in centralizing smallholder farmers' agency and voices.
What is it? (TIMP description)	The framework has increasing productivity and income growth. In this framework, several policies have been formulated and implemented to introduce stability in agricultural output, to commercialise and intensify production, and to promote appropriate and participatory policy formulation and environmental sustainability

	<pre> graph TD A[Agricultural policy framework] --> B[Basic policies] A --> C[Production supporting] A --> D[Benefit protection] B --> B1["•Basic policies •Agricultural land protection •Food security"] C --> C1["•Structural adjustment •Agricultural product quality and safety •Agricultural taxes •Agricultural subsidy •Agricultural products marketing •Agricultural science and technology •Rural finance •Agricultural labour transfer and employment •Infrastructural construction"] D --> D1["•Agricultural product price protection •Agricultural product trading •Agricultural resources and environment protection •Rural development and poverty support policies"] </pre>
Justification	Without making the smallholder farmers' agency and voices central in the agricultural policy discourse, the goals will not be achieved, revolving around increasing productivity and income growth, especially for smallholders; enhanced food security and equity, emphasis on irrigation to introduce stability in agricultural output, commercialisation and intensification of production especially among small scale farmers; appropriate and participatory policy formulation and environmental sustainability.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, processing industries, Extension, NGOs, Research institutions
Approaches to be used in dissemination	Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups, producer organizations
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of stakeholders • Availability of agricultural policies and specific cowpeas-based policies • Availability of policy goals, objectives and key areas of concerns
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Demanding cowpea policies to support production and marketing • County extension staff - Sensitization of farmers • NGOs – Sensitization of farmers • Private sector (local traders and exporters) – Demanding cowpeas policies to support production and marketing • Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Turkana County where cowpea production is suitable and policy making is needed to support production and marketing
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the agricultural

	<p>policies whether National or County</p> <ul style="list-style-type: none"> • Poorly established cowpeas value chain • Cowpeas production are specific to agro-ecological zones and not all the Counties in Kenya grow cowpeas
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organizations as an institution • Small-scale farming – Policies for increasing productivity • Inadequate information to stakeholders on the agricultural policies whether National or County – Sensitization of stakeholders • Poorly established cowpeas value chain – strengthening bean value chain • Cowpeas production are specific to agro-ecological zones and not all the Counties in Kenya grow cowpeas – Diversification of cowpeas
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Low productivity of cowpeas • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Lacking specific cowpeas policy • Market conditions - Poor market infrastructure
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Farmers should produce each kg of cowpeas grain at Ksh 30-35 per kg
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67.
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate women representation in the policy formulation and validation process if they focus and strategize well • Opportunities exist for youth to be adequately represented since they are young and literate therefore they can articulate their issues well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of VMGs in policy development forums at all levels • Inadequate representation of VMGs the policy of validation process
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels of policy formulation because policy frameworks support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are

	available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.
Partner organizations	

Research gaps

Further research

- Effects of policy measures on cowpea production and marketing
- Equity distribution among the stakeholders
- Productivity levels among the smallholder farmers due to farmer-market linking models

2.5.11 Mineral fertiliser policy interventions

TIMP Name	Mineral fertiliser policy interventions
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	One of the most critical drivers of low agricultural productivity is the lagging use of modern inputs, especially fertilizers, and the lack of access to technology. Traditionally, Kenya attempted to solve the issue through public input subsidy programmes. As a result, the Kenyan government is studying alternative approaches to price subsidies in order to increase the ability of all farmers to purchase the right inputs at the right time.
What is it? (TIMP description)	Fertilizer policy in Kenya has interventions to support increasing productivity and income growth. These policy interventions are: Input subsidy programmes, facilitated the establishment of two fertilizer plants through Public-Private Partnership (PPP) projects, development of extension programmes.
Justification	While the intensity of the fertilizer use has rapidly increased in other parts of the world, it has remained at a low level in Sub-Saharan Africa. For instance, while it has increased from 38 kilograms per ha in 1982 to 101 kilograms per ha in 2002 in South Asia, it increased only from 7 to 8 kilograms per ha during the same period in Sub-Saharan Africa. This negligible fertilizer use partly explains lagging agricultural productivity growth in Sub-Saharan. Thus, experts and policy makers agree on the urgent need to increase the use of inorganic fertilizer in the region. There is less consensus on how to address this issue and currently there are marked differences in policies and programs pertaining to fertilizer among African countries. Kenya is one of

	a few African countries, if not the only one, that has thoroughly and successfully implemented fertilizer market reform policy. However, the levels of inorganic fertilizer use is low leading to low productivity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension, NGOs, Research institutions
Approaches to be used in dissemination	Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of stakeholders • Availability of fertilizer policies • Availability of policy goals, objectives and key areas of concerns
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Demanding fertilizer policies to support production and marketing • County extension staff - Sensitization of farmers • NGOs – Sensitization of farmers • Private sector (local traders and exporters) – Demanding cowpeas policies to support production and marketing • Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	All Counties in Kenya for the fertilizer policies but maize growing counties dominate
Counties where TIMPs will be up scaled	Turkana County where cowpea production is suitable
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the fertilizer policy, especially fertilizer distribution
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organizations as an institution • Small-scale farming – Policies for increasing productivity • Inadequate information to stakeholders on the fertilizer policies whether National or County – Sensitization of stakeholders
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Low use of fertilizer • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Lack of participation • Market conditions – High costs and distribution
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Farmers should produce each kg of cowpeas grain at Ksh 30-35 per kg
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67.
Gender issues and concerns in	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy

development and dissemination, adoption and scaling	<p>development forums at all levels</p> <ul style="list-style-type: none"> • Inadequate representation of youth and women in the policy validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate women representation in the policy formulation and validation process if they focus and strategize well • Opportunities exist for youth to be adequately represented since they are young and literate therefore they can articulate their issues well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of VMGs in policy development forums at all levels • Inadequate representation of VMGs the policy of validation process
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels of policy formulation because policy frameworks support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Impact of liberation of fertilizer and uses of fertilizer
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.
Partner organizations	

Research gaps

Further research

- Impact of policy interventions
- Equity distribution among the stakeholders
- Productivity levels among the smallholder farmers
- Income growth

2.5.12 Kenya National Seed Policy 2010 interventions

TIMP Name	Kenya National Seed Policy 2010 interventions
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Seed is one of the most critical inputs in agricultural production, in that it has the greatest potential of increasing on-farm productivity and enhancing food security. It determines the

	upper limit of crop yields and therefore the productivity of all other agricultural inputs in farming systems. However, smallholder farmers face the problems of insufficient certified seed materials, low adoption of improved seed and complementary technologies, inadequate suitable varieties for marginal areas, inaccessibility to affordable credit, prevalence of adulterated seed in the market, high cost of seed, insufficient technical skills and infrastructure for new Technologies and lack of strategic seed reserves.
What is it? (TIMP description)	The National Seed Policy is the Ministry's outline of policy interventions to be pursued in order to address current constraints in the seed sub sector and to improve its performance and contribution towards improved agricultural productivity. The policy interventions are: Increase financial support to research, extension, variety and species development and technology transfer by both private and public sectors, Strengthen modalities for coordination of public and private research and extension service providers for effective transfer and dissemination of seed-related technologies; quality and relevance of extension messages, continue to review variety evaluation, release and registration processes and Put in place clear and transparent procedures for accessing publicly bred varieties and plant species
Justification	In 2010, the Kenya adopted a new overarching national seed policy. The National Seed Policy is the Ministry's outline of policy interventions to be pursued in order to address current constraints in the seed sub sector and to improve its performance and contribution towards improved agricultural productivity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension, NGOs, Research institutions
Approaches to be used in dissemination	Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of stakeholders • Availability of seeds • Availability of policy goals, objectives and key areas of concerns
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Demanding seed policy to support production of cowpeas • County extension staff - Sensitization of farmers • NGOs – Sensitization of farmers • Private sector (local traders and exporters) – Demanding seed policy to support bean production • Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	Counties mainly growing cowpeas
Counties where TIMPs will be up scaled	Turkana County where production of cowpeas is suitable

Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the seed policy, especially seed distribution
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organizations as an institution • Small-scale farming – Seed quality policies for increasing productivity • Inadequate information to stakeholders on the fertilizer policies whether National or County – Sensitization of stakeholders
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Use of local seed • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Lack of participation • Market conditions – High costs and distribution of improved seed
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Farmers should produce each kg of cowpeas grain at Ksh 30-35 per kg
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67.
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate women representation in the policy formulation and validation process if they focus and strategize well • Opportunities exist for youth to be adequately represented since they are young and literate therefore they can articulate their issues well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of VMGs in policy development forums at all levels • Inadequate representation of VMGs the policy of validation process
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels of policy formulation because policy frameworks support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Increase in productivity in households adopted improved cowpea varieties
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2, Requires	Requires validation

validation, 3. Requires further research)	
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.
Partner organizations	

Research gaps

Further research

- Equity distribution among the stakeholders
- Productivity levels among the smallholder farmers
- Farmers' accessibility to fertilizer

2.5.13 National Agricultural Mechanization Policy 2021 interventions

TIMP Name	National Agricultural Mechanization Policy 2021 interventions
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	The relatively low level of mechanization is due to a number of challenges facing the sub-sector. These include; inadequate training, research and technology development; weak local manufacturing and distribution, insufficient agricultural mechanization quality assurance, low level of investments in mechanization services, poor extension and technology adoption, and weak institutional and legal framework. The cross-cutting issues affecting mechanization include matters related to vulnerable groups, gender and youth, negative effects of environment, inappropriate land use and climate change.
What is it? (TIMP description)	The agriculture sector mechanization policy has the following interventions at National and County governments: <ul style="list-style-type: none"> • Institute measures that create an enabling environment to reduce cost of agricultural machinery and equipment; • Stimulate participation of investors and SMEs in manufacture and distribution of agricultural machinery and equipment; • Ensure in collaboration with the private sector for provision of adequate after sales services for agricultural machinery and equipment; • Institute innovative management systems for public and other organizations that offer agricultural mechanization services
Justification	Mechanization plays a key role in enabling the growth of commercial agri-food systems and improving the efficiency of operations along the agriculture value chains. As such, it can have a major influence on the availability and accessibility of more nutritious food, contributing to increased household food

	<p>security. Agricultural mechanization covers all levels of production and processing technologies, from simple and basic hand tools to more sophisticated and motorized equipment. Agricultural Mechanization eases and reduces drudgery, relieves labour shortages, improves productivity. In addition, it also improves timeliness of agricultural operations, increases resource-use efficiency, enhances market access and contributes to mitigating climate-related hazards. Sustainable mechanization considers technological, economic, social, environmental and cultural aspects while contributing to the sustainable development of the agricultural sector. However, in the absence of a clear policy on agricultural mechanization the transformation of agriculture in Kenya will not be realized. For this reason, the Government seeks to focus on development of a National Agricultural Mechanization Policy for long-term economic development</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension, NGOs, Research institutions
Approaches to be used in dissemination	Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • High cost of agricultural machinery and equipment • Inadequate distribution mechanism of agricultural machinery and equipment • Inadequate local manufacturing of agricultural machinery and equipment • Inadequate after sale services • Inadequate information on availability of relevant agricultural machinery and services • Poor management of public owned agricultural machinery
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Demanding mechanization on cowpeas • County government - Interventions • National government - Interventions • NGOs – Sensitization of farmers • Private sector (local manufacturers) • Research institutions – Research
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Turkana County where cowpea production is suitable
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organizations as an institution • Small-scale farming – Cost sharing • Inadequate information - Sensitization of stakeholders

Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – high poverty • Environmental conditions – small farms • Policy conditions – Lack of participation • Market conditions – High costs of machines
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Farmers should produce each kg of cowpeas grain at Ksh 30-35 per kg
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67.
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate women representation in the policy formulation and validation process if they focus and strategize well • Opportunities exist for youth to be adequately represented since they are young and literate therefore they can articulate their issues well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of VMGs in policy development forums at all levels • Inadequate representation of VMGs the policy of validation process
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels of policy formulation because policy frameworks support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R. Wambua, J. and Maina, F.
Partner organizations	

Research gaps

Further research

- Adoption of mechanization
- Equity distribution among the stakeholders
- Productivity levels among the smallholder farmers
- Farmer accessibility to machines

2.5.14 Kenya climate smart agriculture policy interventions

TIMP Name	Kenya climate smart agriculture policy interventions
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	The changes in climate and weather patterns will expose the rain-fed farming systems, especially the arid and semi-arid lands, to more climate related vulnerabilities. This will predispose farming communities to food insecurity and poverty through loss of the productive assets and the weakening of coping strategies and resilience.
What is it? (TIMP description)	Climate smart agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. CSA aims to achieve three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible. Climate smart agriculture is the pathway that leads to attainment of the national interests of food security, productivity and incomes, while at the same time reducing or sequestering greenhouse gas emissions.
Justification	The country requires transformation of its agricultural systems to make them more productive and resilient while minimizing GHG emissions under a changing climate. CSA provides an excellent opportunity for the transformation by uniting agriculture, development and climate change under a common agenda through integrating the three dimensions of sustainable development (economic, social and environmental) by jointly addressing food security and climate challenges. CSA therefore sustainably increases agricultural production and incomes, builds resilience of agricultural systems to climate change and minimizes GHGs emissions. However existing national strategies and interventions such as the National Climate Change Action Plan (2013-2017) and the Agriculture Sector Development Strategy (2010-2020) have not adequately mainstreamed adaptation, building resilience and mitigation of GHG's into the agricultural sector. Consequently, the sector needs a sound and enabling CSA strategy that will simultaneously guarantee productivity and food security while addressing climate change adaptation and mitigation
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension, NGOs, Research institutions
Approaches to be used in dissemination	Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for	<ul style="list-style-type: none"> • Availability of stakeholders

successful promotion	<ul style="list-style-type: none"> • Availability of policy goals, objectives and key areas of concerns
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Demanding policy to support • 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	None
Counties where TIMPs will be up scaled	Turkana County where cowpea production is suitable
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organizations as an institution • Small-scale farming – sensitization • Inadequate information to stakeholders– Sensitization of stakeholders
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Low knowledge about climate change • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Lack of participation • Market conditions – Demand of crop production tolerance to climate change
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Farmers should produce each kg of cowpeas grain at Ksh 30-35 per kg
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67.
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate women representation in the policy formulation and validation process if they focus and strategize well • Opportunities exist for youth to be adequately represented since they are young and literate therefore they can articulate their issues well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of VMGs in policy development forums at all levels • Inadequate representation of VMGs the policy of validation process
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels

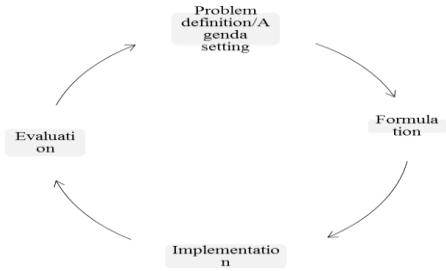
	of policy formulation because policy frameworks support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.
Partner organizations	

Research gaps

Further research

- Equity distribution among the stakeholders
- Productivity levels among the smallholder farmers
- Farmer accessibility to climate smart technologies

2.5.15 Policy cycle

TIMP Name	Policy cycle
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of stakeholders' engagement and centralization of smallholder farmers' agency and voices in agricultural policy making.
What is it? (TIMP description)	<p>Policy cycle is used in the development and validation of agricultural policies for the agriculture and rural development. The cycle has four components; problem identification, policy formulation, implementation and evaluation.</p>  <pre> graph TD A[Problem definition/A agenda setting] --> B[Formulation] B --> C[Implementation] C --> D[Evaluation] D --> A </pre>
Justification	Agricultural policy goals in Kenya revolves around increasing productivity and income growth, especially for smallholders; enhanced food security and equity, emphasis on irrigation to

	introduce stability in agricultural output, commercialisation and intensification of production especially among small scale farmers; appropriate and participatory policy formulation and environmental sustainability.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, processing industries, Extension, NGOs, Research institutions
Approaches to be used in dissemination	Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of stakeholders • Availability of agricultural policies and specific cowpeas-based policies • Availability of policy goals, objectives and key areas of concerns
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Demanding cowpea policies to support production and marketing • County extension staff - Sensitization of farmers • NGOs – Sensitization of farmers • Private sector (local traders and exporters) – Demanding cowpea policies to support production and marketing • Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Turkana County where cowpea production dominates
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the agricultural policies whether National or County • Poorly established cowpea value chain • Cowpea production are specific to agro-ecological zones and not all the Counties in Kenya grow cowpeas
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organizations as an institution • Small-scale farming – Policies for increasing productivity • Inadequate information to stakeholders on the agricultural policies whether National or County – Sensitization of stakeholders • Poorly established cowpeas value chain – strengthening bean value chain • Cowpeas production are specific to agro-ecological zones and not all the Counties in Kenya grow cowpeas – Diversification of cowpeas
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None

Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Low productivity of cowpea • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Lacking specific cowpea policy • Market conditions - Poor market infrastructure
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Farmers should produce each kg of cowpeas grain at Ksh 30-35 per kg
Estimated returns	The estimated returns at farm gate price at KES 45-50, at market price Ksh 60-67.
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate women representation in the policy formulation and validation process if they focus and strategize well • Opportunities exist for youth to be adequately represented since they are young and literate therefore they can articulate their issues well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of VMGs in policy development forums at all levels • Inadequate representation of VMGs the policy of validation process
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels of policy formulation because policy frameworks support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, AMRI, KALRO Katumani
Lead organization and scientists	KALRO Katumani – Wangari, R.; Wambua, J. and Maina, F.
Partner organizations	

Research gaps

Further research

- Validation of policy cycle
- Participatory policies generated
- Involvement of stakeholders



NATIONAL AGRICULTURAL AND RURAL
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