KALRO
Kenya Agricultural & Livestock Research Organization

NAVCDP
NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT

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









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OCTOBER 2023

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 agro-climatic zones from their area agricultural extension officers.

Published by
Kenya Agricultural and Livestock Research Organization
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FOREWORD

The Kenya Agricultural and Livestock Research Organization (KALRO) through the support of development partners has laid a strong foundation for growth and commercialization of agriculture in Kenya. This has been done through the development of Climate Smart Technologies, Innovations and Management Practices (TIMPs) through the adaptive and applied research guided by some of the research gaps identified earlier. In addition, the organization has embraced an interconnected information communication technology to ease the handling of data and information from research. A notable inclusion is the use of the Big Data Platform to integrate digital information from value chains. The National Agricultural Value Chain Development Project (NAVCDP) seeks to build on and deepen investments into interventions on productivity enhancement, community-led farmer extension, water management investments and data-driven value chain services from KCSAP and NARIGP previous projects. In this NAVCDP project, KALRO seeks to strengthen, customize and update the existing inventories of TIMPs, with emphasis on climate resilience, safer food production practices, value addition, nutrition, market participation and commercialization.

With the continued support, KALRO also is poised to continue providing quality technical assistance for value chain development at all levels and build capacity of county level implementation units to anchor project activities. With the support of NAVCDP, KALRO has developed inventories of TIMPs for the two new value chains, pyrethrum and rice and is continuously expanding, updating and revising existing inventories of TIMPs. In doing so, KALRO further strengthens climate resilience, value addition and market participation aspects of the updated TIMPs to support farmers to transition from subsistence to commercial farming. The organization continues to support the strengthening of the current Big Data platform at KALRO as the foundational database for insight-driven, more productive, resource efficient and climate-resilient farming. To enhance the effective coordination of research linkages and agriculture digitization, KALRO and the Ministry of Agriculture and Livestock Development have put in relevant support mechanisms to oversee the implementation of these activities.

Extensive information from research and background data has been used to develop this revised Inventory of TIMPs for the Cashew Value chain. 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 a uniform outline that ensures every aspect of the TIMPs are fully covered in way that the trainees can absorb and relate to. Various delivery methods are deployed and where possible demonstrations and practical work are incorporated to enable the trainees learn by participating in the actual field activities. The use of this TIMPs inventory is expected to contribute to the achievement of the Project Development Objective (PDO), which is to increase market participation and value addition for targeted farmers in select value chains in project areas. This revised TIMPs inventory is to be used in conjunction with the respective ToT Manual.

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

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

PREFACE

The National Agricultural Value Chain Development Project (NAVCDP) is a Government of Kenya project with support from the World Bank. The five-year project is being implemented in 34 counties clustered in seven regions at an approximate cost of U$ 275 million. The project development objective (PDO) is "increase market participation and value addition for targeted farmers in select value chains in project areas." It is expected that this objective will be achieved through implementing the five project components, namely; Building Producer capacity for climate resilient stronger value chains; Climate Smart Value Chain Ecosystem Investments; Piloting Climate Smart Safer Urban Food Systems; Project Coordination and Management; and Contingent Emergency Response Component.

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

The National Agricultural Value Chain Development Project has partnered with KALRO to continue strengthening and expanding the existing inventory of TIMPs with an emphasis on climate resilience, value addition, nutrition, and safer food production practices. Through this partnership, KALRO has developed Technologies, Innovations and Management Practices (TIMPs) inventories for the two new value chains - Rice and Pyrethrum, and revised existing inventories of TIMPs for all other value chains developed during the implementation of KCSAP and NARIGP. It also supports the strengthening of the existing Big Data platform at KALRO as the foundational database for insight-driven, more productive, resource-efficient and climate-resilient farming. Finally, the Ministry of Agriculture, Livestock Development (MoALD) has put in place relevant support mechanisms with KALRO to oversee effective implementation, coordination of research linkages and agriculture digitization.

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

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

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

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ABBREVIATIONS AND ACRONYMS

AKEFEMA	Association of Kenya feed manufacturers
AI	Artificial insemination
AIP	Agricultural innovation platforms
APSK	Animal Production Society of Kenya
ARLRI	Arid and Rangelands Research Institute
ART	Assisted Reproductive Technologies
ASALs	Arid and Semi-Arid Lands
ASK	Agricultural Society of Kenya
BECA	Bio Science Eastern and Central Africa
BETA	Bottom up Economic Transformation Agenda
BioRI	Biotechnology Research Institute
BOD	Biological oxygen demand
BSF	Black Soldier Fly
BW	Body weight
CA	Conservation Agriculture
CBOs	Community based organization
CCPP	Contagious caprine pleuropneumonia
CF	Crude Fibre
CGIAR	Consultative Group for International Agricultural Research
CHROX	Chloris roxburghiana
CIG	Common Interest Group
COD	Chemical Oxygen Demand
COMESA	Common markets for East and southern Africa
CP	Crude Protein
CSA	Climate Smart Agriculture
DRI	Dairy Research Institute
EAC	East African Community
ERC	Energy Regulatory Commission
EMCA	Environmental Management Coordination Act

ENMA	Enteropogon macrostachyus
ERSU	Eragrostis superba
DGAK	Dairy Goats Association of Kenya
DGBA	Dairy Goats breeders association
DIVA	Differentiating Vaccine
DLPO	Director Livestock Production Office
DM	Dry matter
DVS	Director of Veterinary Services
EAAPP	East African Agricultural and Productivity Project
FBO	Farmer Based Organization
FFBS	Farmer Field and Business School
FFS	Farmer Field School
FMD	Foot and Mouth Disease
FSMS	Food Safety Management System
GAP	Good Agricultural Practice
GHG	Green House Gas
GTZ	German Technical Corporation
HACCP	Hazard Analysis and Critical Control Points
HAC	High Altitude Composite
HIVOS	Humanist Institute for Development Cooperation
HPI	Heifer Project International
ICIPE	International Centre of Insect Physiology and Ecology
ICM	Integrated Crop Management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information Communication Technology
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IPM	Integrated Pest Management
ISDA	Innovative Solution for Decision Agriculture
JKUAT	Jomo Kenyatta University of Science and Technology

KAGRC	Kenya Animal Genetics Resources Centre
KAK 1/2/3	Kakamega 1, 2 and 3
KALPRO	KALRO Probiotics
KALRO	Kenya Agricultural and Livestock Research Organization
KAPALIG	Kavatini Pastoralists Livestock Improvement Group
KBK	Kiboko
KBP	Kenya Biogas Programme
KCSAP	Kenya Climate-Smart Agriculture Project
KDB	Kenya Dairy Board
KEBS	Kenya Bureau of Standards
KEFRI	Kenya Forestry Research Institute
KEPHIS	Kenya Plant Health Inspectorate Service
KES	Kenya Shillings
KEVEVAPI	Kenya veterinary vaccines production institute
KIOF	Kenya Institute of organic farming
KIRDI	Kenya Industrial Research & Development Institute
KLBA	Kenya Livestock Breeders Association
KMGBA	Kitui Mwingi Goat Breeders association
KENBIM	Kenya National Domestic Biogas Programme
KWFT	Kenya Women Finance Trust
LAB	Lactic Acid Bacilli
LBW	Live Body Weight
LH	Lower Highlands
LSD	Lumpy Skin Disease
MGBA	Meru goat breeders association
MGD	Magadi
MoALD	Ministry of Agriculture & Livestock Development
MSD	Maize silage supplemented with dairy meal
MSL	Maize silage supplemented with lupin seed-based concentrates
MSP	Maize silage supplemented with poultry waste-based concentrates

MSMEs	Micro, Small and medium enterprises
NACl	Sodium Chloride
NARI	National Agricultural Research Institute
NALIRRI	National Livestock Resources Research Institute
NARS	National Agricultural Research Systems
NAVCDP	National Agricultural Value Chain Development Project
NAMA	Nationally Appropriate Mitigation Action
NDA	National Designated Authority
NDDP	National Dairy Development Project
NDGFA	Nyanza Dairy Goat Farmers Association
NGO	Non-Governmental Organization
NPT	National Performance Trials
PCPB	Pest Control Products Board
PTRE	Phytochemicals textiles and renewable energy
RD	Rhodes grass hay supplemented with dairy meal concentrates
RL	Rhodes grass hay supplemented with lupin seed-based concentrate
RP	Rhodes grass hay supplemented with poultry waste-based concentrate
SEAZ	Small East African Zebu
SCODE	Sustainable Community Development Services
SDCP	Smallholder Dairy Commercialization programme
SDL	State Department for Livestock
SNV	Netherlands Development Organisation
SPV	Sweet Potato Vines
TDS	Total dissolved solids
TIMPs	Technologies, Innovation and Management Practices
TMR	Total Mixed Rations
TNGB	Tharaka Nithi Goat breeders
ToT	Training of Trainer
TVT	Taveta
USD	United States Dollars

USSD	Unstructured Supplementary Service Data
VC	Value Chain
VMGs	Vulnerable and Marginalized Group

1.0 Definition of terms and summary tables of Dairy Technologies, Innovations and Management Practices (TIMPs)

1.1 Definition of terms

Technology: This is defined as an output of a research process which is beneficial to the target clientele (mainly farmers, pastoralists, agro-pastoralists and fisher folk for KCSAP'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 defined as recommendation(s) on practice(s) that is/are considered necessary for a technology to achieve its optimum output. These include, for instance, different agronomic practices (seeding rates, fertilizer application rates, spatial arrangements, planting period, land preparation, watering regimes, etc.), protection methods, for crops; and feed rations, management systems, disease control methods, etc. for animal breeds. This is therefore important information that is generated through research to accompany the parent technology before it is finally released to users and the technology would be incomplete without this information.

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

Detailed Dairy Goat Value Chain TIMPs

1.1.1 Summary of Inventory of TIMPs in the Dairy Goat Value Chain

The inventory process resulted in a total of 48 TIMPs including 33 technologies, 1 innovation and 14 management practices, distributed among the 8 sub-themes, as indicated in Table 1.

Table 1: Summary of dairy goat TIMPs

Commodity/ VC	Sub-Theme	Technologies	Innovations	Management Practices
Dairy Goat	Breeds and breeding	0	0	4
Dairy Goat	Feeds and Feeding	13	0	0
Dairy Goat	Forage production	5	0	1
Dairy Goat	Feed formulation	2	1	3
Dairy Goat	Dairy goat housing	0	0	1
Dairy Goat	Value addition-Dairy goat milk	6	0	0
Dairy Goat	Dairy Goat Health Management	97	0	02
Dairy Goat	Dairy goat Commercialization, Marketing and Policy Options	0	0	3
Overall Total		**33**	**01**	**14**

1.1.2 Summary of Status of TIMPs in Dairy goat Value Chain

The inventory process resulted in a total of 36 TIMPs that are ready for upscaling and 11 TIMP that require validation and 1 TIMP for further research in the 8 sub-themes, as indicated in Table 2.

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

Commodity/VC	Sub-Theme	Ready for upscaling	Require validation	Further Research
Dairy Goat	Breeds and breeding	4	0	0
Dairy Goat	Feeds and Feeding	12	1	0
Dairy Goat	Forage production	1	04	1
Dairy Goat	Feed formulation	64	2	0
Dairy Goat	Dairy goat housing	1	0	0
Dairy Goat	Value addition-Dairy goat milk	6	0	0
Dairy Goat	Dairy Goat Health Management	95	4	0
Dairy Goat	Dairy goat Commercialization, Marketing and Policy Options	3	0	0
Overall Total		**436**	**11**	**01**

1.1.3 Summary of Inventory of TIMPs in the Dairy Goat Value Chain

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
	Dairy Goats Value Chain		
2.1. Breeds and breeding	3.1.1 Dairy Goat Breeding management	Management practice	Ready for Upscaling
	3.1.2 Dairy goat community based breeding program	Management practice	Ready for Upscaling
	3.1.3 Dairy goat kid management guide	Management practice	Ready for Upscaling
	3.1.4 Identification and recording	Management practice	Ready for Upscaling
2.2. Feeds and Feeding	3.2.1 Improved Napier grass varieties (Kakamega 1, 2, and 3; Ouma; South Africa)	Technology	Ready for upscaling
	3.2.2 Oats for dairy production in frost prone areas	Technology	Ready for upscaling
	3.2.3 High altitude composite maize fodder	Technology	Ready for upscaling
	3.2.4 Fodder sorghum (*Sorghum bicolor*) variety- E6518	Technology	Ready for upscaling
	3.2.5 Climate smart Brachiaria Grass	Technology	Ready for upscaling
	3.2.6 Common vetch – *Vicia sativa* fodder	Technology	Ready for upscaling
	3.2.7 Desmodium (*Desmodium intortum*)- Napier grass intercrop	Technology	Ready for upscaling

	3.2.8 Tree Lucerne or tagasaste-*Chamaecytisus prolifer*	Technology	Ready for upscaling and validation
	3.2.9 Sweet lupin (*Lupinus albus* and *Lupinus angustifolius*)	Technology	Ready for upscaling and validation
	3.2.10 Sweet potato vines	Technology	Ready for upscaling
	3.2.11 Cassava based Napier grass silage	Technology	Ready for upscaling
	32.2.12 Napier grass and gliricidia leaves silage	Technology	Ready for upscaling
	3.2.13 Oat/Napier- vetch legume intercrop	Technology	Require validation
2.3 Forage production	3.3.1 Buffel grass (Cenchrus ciliaris) var. MGD-1	Technology	RRequire validation
	3.3.2 Buffel grass (Cenchrus ciliaris) var. TVT-3	Technology	Require validation
	3.3.3 Bushrye grass (Enteropogon macrostachyus) var. ENMA-KBK	Technology	RFurther research
	3.3.4 Horsetail grass (Chloris roxburghiana) var. CHROX-KBK	Technology	RRequire validation
	3.3.5 Maasai Love Grass (Eragrostis superba) var. ERSU-1	Technology	RRequire validation
	3.3.6 Community based range grass seed bulking	Management Practice	Ready for upscaling
2.4 Feed formulation	3.4.1 Group bottle feeding of milk to kids	Technology	Ready for upscaling
	3.4.2 Sweet potato vines milk replacer for kids	Innovation	RRequire validation
	3.4.3 Feeds for doelings	Management practice	Ready for upscaling
	3.4.4 Feeding for the lactating doe	Management Practice	Ready for upscaling
	3.4.5 Feeding a breeding buck	Management practice	Ready for upscaling
	3.4.6 A home-made ration for lactating dairy goats	Technology	RRequire validation
2.5. Dairy goat housing	3.5.1 Dairy goat housing	Management practice	Ready for upscaling
2.6 Value addition-Dairy goat milk	3.6.1 Pasteurized goat milk	Technology	Ready for upscaling
	3.6.2 Yoghurt	Technology	Ready for upscaling
	3.6.3 *Maziwa lala*	Technology	Ready for upscaling
	3.6.4 Cheese	Technology	Ready for upscaling
	3.6.5 Butter	Technology	Ready for upscaling

	3.6.6 Ghee	Technology	Ready for upscaling
2.7 Dairy Goat Health Management	3.7.1 Thermo-tolerant Peste des Petits Ruminants (PPR) Vaccine	Technology	RRequire validation
	3.7.2 Latex agglutination diagnostic test	Technology	Ready for upscaling
	3.7.3 Integrated Helminth Control	Technology	Ready for upscaling
	3.7.4 Push-Pull for tsetse fly control	Technology	RRequires validation
	3.7.5 Protocol for Controlling Mastitis	Management Practice	RRequires validation
	3.7.6 Contagious Caprine Pleuro-pneumonia (CCPP) DIVA Vaccine	Technology	Ready for upscaling
	3.7.7 Protocol for Production of Contaminant-free Milk	Management practice	Ready for upscaling
	3.7.8 Protocols for Reducing Infertility in Dairy Animals	Technology	Ready for upscaling
	3.7.9 pH-based Mastitis Kit	Technology	RRequires validation
2.8 Dairy goat Commercialization, Marketing and Policy Options	3.8.1 Dairy goat commercialization	Management practice	Ready for upscaling
	3.8.2 Dairy goat Marketing	Management practice	Ready for upscaling
	3.8.3 Dairy goat Policy options and regulations	Management practice	Ready for upscaling

2.1 Dairy goat breeding and breeds improvement

2.1.1 Goat Breeds and Breeding

2.1.1 TIMP name	**BDairy Goat Breeding management**
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Low milk productivity (500ml per day) by the existing dairy goat breeds • Scarcity of germplasm from dairy goat breeds with excellent milk output potential, disease resistance, and heat tolerance

	• Inadequate knowledge on dairy goats breed productive potential. • Increased GHGs emissions is higher in low producing breeds
What is it? (TIMP description)	Good dairy goat breeding entails selecting parents (does and bucks) from the dairy goat population based on traits of economic importance to farmers. Some of the choice breeding traits include growth and body weights, milk production potential, reproductive qualities, survival rate and health traits. The breeding should be carefully done and if possible records used to ensure animals related to each other are not used in the breeding program to minimize chances of inbreeding. The breeding can be done among a specific exotic goat breed line or between one exotic goat breed and the other. It is also possible to use exotic dairy goat breeds to upgrade the local goat breeds like Galla through cross breeding.
Justification	Kenya's dairy goats breeds include Alpine, Saanen, Toggenburg, Anglo Nubian and crosses of local and exotic breeds. Goat improvement in Kenya has been achieved through upgrading systems using buck rotational schemes which are sometimes faced with challenges of inadequate and unavailability of quality breeding bucks. The resultant effect is narrowing of the genetic pool and rising levels of inbreeding leading to low productivity and unavailability of superior germplasm and emission of GHGs. To overcome these challenges, breed selection in breeding programs is important. Good breeding stock is selected from among does and bucks with documented heritage. Good breeding is done through effective heat detection among bucks before allowing mating in suitable environments. Participating goat breeders' association maintain good records of choice bucks and does to prevent in breeding.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension, Researchers, Dairy goat breeders association, agri-preneurs

Approaches to be used in dissemination	• Public and private agricultural extension servicesFarmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Functional Dairy Goat Breeders Associations (DGBA) • Performance recording and registration of the offspring in the farms • Year-round availability of quality feeds
Partners/stakeholders for scaling up and their roles	• Extension service providers (public and private) – to train farmers on various dairy goat breeds and breeding system and monitor implementation • KALRO – technology development and fine tuning, ToT, backstopping and monitor implementation • Kenya Livestock Breeders Association (KLBA) - maintain records and issue registration certificates for the animals • Dairy Goat Breeders Association (DGBA) Maintain records and monitoring of the breeds and breeding, and marketing of breeding goats • Established multipliers in various counties – train other farmers in the lower cadres
C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri, Kakamega and Tharaka Nithi
Counties where TIMP will be upscaled	Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi
Challenges in dissemination	• Uncontrolled breeding • Weak livestock recording and registration • LInadequate knowledge on breeds and breeding management • Insufficient extension publications
Suggestions for addressing the challenges	• Training in breeds and breeding management

	• Documentation of breeds and breeding and knowledge sharing • Support for livestock recording and registration • Develop and avail user information on proper breeding management
Lessons learned in upscaling if any	• Improved breeds and breeding increases milk production potential • With better breeds and good breeding farmers have goats that are more resilient and cheaper to manage
Social, environmental, policy and market conditions necessary for development and upscaling	• Controlled breeding and use of quality germplasm is socially acceptable • Improved breeds that result from a controlled breeding have high milk production potential and low GHG emissions. • Policy changes in governments encouraging farming community to use some of the produce at farm level to enhance their nutritional security • The market for goat milk and breeding animals are high and will take up the increased amount emanating from improved breeds. • Good milk and breeding animals' market and value addition to cater for increased production
Basic costs of the TIMP	• Cost of mating service using a superior buck owned by dairy goat breeders association- KES 100 per mating
Estimated returns when using the TIMP	If proper breeding management is done, it may result in economic gains arising from superior germplasm. Milk production will progressively improve from 500ml per day per doe to about 2-3 liters per day per doe
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women perform most of the dairy goat activities such as milking therefore the technology may increase their work burden • Women may have limited access to markets and extension services • Women may have limited access to education, training and extension services. • Women may have limited access to credit, implements and inputs for dairy goat production • Women and youth may have limited access to land for dairy goat production • Men dominant decisions at the household and community levels
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit

	• Employment opportunities exist for youths in performing the task
VMG issues and concerns in development, dissemination adoption and scaling up	• VMGs may also have limited access to resources such as credit, and land required for the technology • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit • •Employment opportunities exist for VMGs in performing the task
E: Case studies/profiles of success stories	
Success stories from previous similar projects	A multiplier in Kakamega who keeps pure breeds of dairy goats like Alpine, Saanen and Toggenburg has seen milk production increase to 2 liters per doe per day Saanen multiplier in Nyeri: has upgraded the flock up to 87.5% Saanen
Application guidelines for users	1. Waineina, R.W., Wasike, CB, Mwangi, S.I, Kiura, J.N., Ondoro, D, Gachina, W, Wahome, C., Mukhebi, L., Nyambati, E.M. and Ilatsia E. (2021). Dairy Goat Management- Resource Book. *A Publication of the Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya*. Page 3-13. ISBN: .978-9966-30-112-3 *2.* Waineina, R.W., Mwangi, S.I., Wasike, C.B., Kiura, J.N. & Ilatsia, E.D. (2022). Dairy Goat Germplasm Multiplication and Delivery to smallholder farmers. *End of KCSAP dairy goat seed system project report.* *3.* Waineina, R.W., Mwangi, S.I., Wasike, C.B., Kiplangat, N., Kiura, J.N. & Ilatsia, E.D. (2022). Determining the performance of different dairy goat breeds under different production systems and agro-ecological zones. *End of KCSAP dairy goat applied project report.* 4. Wasike CB, Waineina RW, Ngeno, DK, Miyumo, SA, Kamidi, CM, Mwabili, JM, Mbaire, F & Ilatsia ED (2022). Estimates of Variance Components and Genetic Parameters for Preweaning Weekly Weight in Dairy Goats using Random Regression Models. *Small Ruminant Research* 5. Kamidi C.M., Waineina R.W., Wasike C.B., Ilatsia E. D., & Ngeno K. (2022). Genetic Diversity and Population Structure of Dairy Goat Populations in Kenya. *Proceedings of the 12th World Congress on Genetics Applied to Livestock*

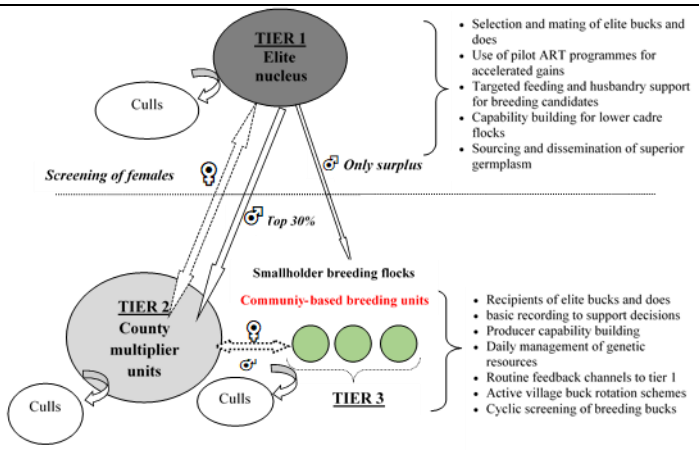
	Production, Rotterdam, The Netherlands from 3rd to 8th July, 2022
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Institute Director, KALRO DRI Naivasha P.O. Box 25 -20117 Naivasha, Kenya Email: director.dri@kalro.org Tel: + 020 2390930
Lead organization and scientists	KALRO, Waineina R.W., Kiura J.N., Wasike CB, Mwangi S.I, Ondoro D, Gachina W, Mwangi S I, Wahome C Mukhebi L., Nyambati E.M. and Ilatsia E.
Partner organizations	Egerton University, Maseno University, Kenya Livestock Breeders Association, Dairy Goat Breeders Associations (Dairy Goat Association of Kenya, Tharaka Nithi Dairy Goat Breeders Association)

RGaps

1. Determine performance of various breeds in different ecological zones
2. Determine the genetic composition of dairy goat in various counties

2.1.2 Dairy goat community based breeding program

2.1.2 TIMP name	**Dairy goat community based breeding program**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Reduced productivity of dairy goat breeds due uncontrolled breeding system • in the dairy goat enterprise has resulted to, Inadequate breeding stock breedingThis has negatively affected goats productivity and household income and high emission of GHGs.
What is it? (TIMP description)	Community-based breeding programs (CBBPs) entailed identifying strategic multipliers and partner nucleus farms under a three-tier breeding structure. Tier 1 – Research centers and progressive individual farms Tier 2 - County multiplier units Tier 3 – Ordinary dairy goat farmers Superior germplasm is kept in Tier 1 and then disseminated to Tier 2. Tier 3 benefits with improved germplasm from Tier 2.

	
Justification	The breeding program details elaborate performance and pedigree recording systems, consistent identification and registration systems, genetic evaluation based on empirical data, a systematic selection process for promising candidates and mating systems for the multiplication and distribution of superior animals to farmers. The CBBP ensures future sustainable supply of breeding bucks and does to bridge the supply deficit in respective counties and countries as a whole. The productivity is achieved by keeping superior goats which emits less GHGs.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension, Researchers, Dairy goat breeders associations, agri-preneurs
Approaches to be used in dissemination	• Public and private agricultural extension servicesFarmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Functional regional centres for sustainable supply of semen and bucks • Functional dairy goat breeders associations • Proper maintenance of records of parents (sire and dam) to avoid inbreeding

	• Performance recording and registration of the offspring in the farms • Year-round availability of quality feeds
Partners/stakeholders for scaling up and their roles	• Extension service providers (public and private) – to train farmers on CBPPs and monitor implementation • KALRO – technology development and fine tuning, ToT, backstopping and monitor implementation • Kenya Livestock Breeders Association (KLBA) - maintain records of the up-grading scheme for crosses and issue registration certificates for the animals • Kenya Animal Genetic Resources Centre (KAGRC) – collect semen of selected bucks from KALRO and other centres
C: Current situation and future scaling up	
Counties where already promoted if any	Kakamega, Nyeri, Tharaka Nithi
Counties where TIMP will be upscaled	Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi
Challenges in dissemination	• Buck keepers neglecting the bucks because they are not individually owned • Weak livestock recording and registration • Inadequate feeds for the bucks kept in the community • Inadequate extension publications • Lack of proper understanding of CBBPs process
Suggestions for addressing the challenges	• Sensitize buck keepers to ensure the buck is taken care of well for for optimal breeding services • Support for livestock recording and registration • Training in CBBPs to all the dairy goat farmers • Documentation of CBBPs and knowledge sharing • Training on feed conservation
Lessons learned in upscaling if any	The buck keeper requires extra resources to properly manage and maintain the buck
Social, environmental, policy and market conditions necessary for development and upscaling	• Awareness and acceptance of CBBPs (milk is an important part of the local diet and any technology to increase milk production will be readily acceptable) • Promotion of nutrient cycling which is good for the environment • The community buck breeding program should be implemented in conformity with the guidelines by the Kenya Livestock Breeders Association

	• Good milk market and value addition to cater for increased production
Basic costs of the TIMP	Not determined
Estimated returns when using the TIMP	TNot determined
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have limited access to CBBP information and knowledge • Women may have limited access to education, training and extension services • The livestock enterprise is mostly owned by men who dominated decisions at the household and community levels • Women may have limited access to resources such as credit and inputs for CBBP management practice infrastructural facilities • Men dominate decision on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit to invest in dairy goat farming • Employment opportunities for youths exist in participate in the CBBP as service providers
VMG issues and concerns in development, dissemination adoption and scaling up	• VMGs may have limite access to agricultural information, technology and knowledge • VMGs may also have limited access to finances to acquire the required infrastructure • VMGs have limited access to education, training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit to invest in dairy goat farming • Employment opportunities for youths exist in performing the task and agri-business skills
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Kakamega, Nyeri and Tharaka Nithi
Application guidelines for users	Waineina, R.W., Mwangi, S.I., Wasike, C.B., Kiura, J.N. & Ilatsia, E.D. (2022). Dairy Goat Germplasm Multiplication and Delivery to smallholder farmers. *End of KCSAP dairy goat seed system project report.* Available in hard copy at KALRO

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 DRI Naivasha P.O. Box 25 -20117 Naivasha, Kenya Email: director.dri@kalro.org Tel: + 020 2390930
Lead organization and scientists	KALRO - Ruth Waineina, Joseph Kiura, Samson Mwangi, Thomas Mwaura, Wasike Bwire, Leonard Mukhebi Daniel Mwangi and Evans Ilatsia
Partner organizations	Maseno University, Livestock Recording Centre, KLBA, Kenya Animal Genetic Resources Centre (KAGRC), KLBA, MoALD

RGaps

- Establishing a community breeding farm

2.1.3 Dairy goat kid management guide

2.1.3 TIMP name	**Dairy goat kid management guide**
Category (i.e. technology, innovation or management practice)	Management Practices
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Reduced productivity due to high mortality rate decreased kid performance,Inadequate young stock for use as replacement stock
What is it? (TIMP description)	Kid management is a process that involves the care given to goat kids from birth until weaning (the first 3 months). This important to increase survival rates and also ensure that the kids growth and weight gain is good. Management procedures for dairy goat kids include: • MCare of goat kids at birth including preparation for period slightly before kidding, at the time of kdding, care of kids immediately after birth). It is critical to ensure the kids consume colostrum soon after birth.) • Feeding of kids (preparation of milk, how to feed, foster feeding) • Routine management practices for kids (identification, castration, weighing, cleaning kid pens) • Housing kids should be done in appropriate house which provide the necessary conditions like ventilation and warmth

	• Control of diseases and parasites through measures such as spraying, vaccination, deworming among others
Justification	Kid rearing is a critical management component of a dairy goat enterprise. The kid management process has the largest impact on the dairy goat flock's long-term output and productivity. In addition high mortality translates to loss of income for the household. The dairy goat kid provides a genetic resource required to replace the flock due to death, culling, and sales. Management of kids wil aim to: • Optimize the crop of weaners • Reduce kid mortality to about 5% • Improve kid performance e.g. growth rate • Attain desirable weight (24 kg) and age (12 months) at first mating
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension, Researchers, input suppliers, service providers, agri-preneurs, Dairy goat breeders associations
Approaches to be used in dissemination	• Public and private agricultural extension servicesFarmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Knowledge and skills on goat kid husbandry practices • Year-round availability of quality feeds • Availability of housing units for goat kids • Good record keeping practice
Partners/stakeholders for scaling up and their roles	• Extension service providers (public and private) – to train farmers on kid management and monitor implementation • KALRO – technology development and fine tuning, ToT, backstopping and monitor implementation • Kenya Livestock Breeders Association (KLBA) -maintain records and issue registration certificates for the animals • Dairy Goat Breeders Association (DGBA) Maintain records and monitoring of the kid management and marketing of breeding goats • Established multipliers in various counties – train other farmers in the lower cadres

C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri, Kakamega and Tharaka Nithi
Counties where TIMP will be upscaled	Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi
Challenges in dissemination	• limited skills in goat kid Husbandry practices • Weak livestock recording and registration • Feed unavailability • Insufficient extension publications
Suggestions for addressing the challenges	• Training in kid management • Encourage the use of an extension model where farmers learn from other farmers • Plant feeds and also conserve the feeds during periods of surplus • Documentation of kid management guide and knowledge sharing • Support for livestock recording and registration
Lessons learned in upscaling if any	• It is necessary to eliminate cultural myths like *males kids are not important for dairy goat enterprise*
Social, environmental, policy and market conditions necessary for development and upscaling	• Awareness and acceptance of the consumption of goat milk • Promotion of nutrient cycling • Goat kid management should comply with animal welfare guidelines • Good milk and breeding animals market and value addition to cater for increased production
Basic costs of the TIMP	Not determined
Estimated returns when using the TIMP	Not determined
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Cultural concerns	Perceptions of goat milk consumption in some communities
Gender issues and concerns in, dissemination, adoption and scaling up	• Women mostly perform the task of Dairy goat kid management • Women may have limited access and extension services • Women have limited access to education, training and extension services. • Women may have limited access to production resources such as land, capital, extension services and credit • Women and youth may have limited access to land for dairy goat production • Men dominant decisions at the household level

Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Employment opportunities exist for women in performing goat kid management
VMG issues and concerns in development, dissemination adoption and scaling up	• VMGs may also have limited access to resources such as credit, and land required for the management practice • VMGs may have limited access to education, training and extension services • Due to their social status VMGs may often be excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness. • Training programs not accommodating for VMGs e.g. materials not in in accessible formats for VMGs lack of sign language interpreters, and physical facilities that are wheelchair-friendly
VMG related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Employment opportunities exist for women in performing goat kid management
E: Case studies/profiles of success stories	
Success stories from previous similar projects	1. A multiplier in Kakamega who sells over 60 breeding goats every year has managed to reduce kid mortality to less than 5 %. Saanen breed multiplier in Nyeri due to good management practices in his herd has achieved almost 0% kid mortality rate.
Application guidelines for users	1. Ilatsia, E.D., Waineina, R.W., Wasike, C.B., Magothe, T.M., Mwangi, S.I. & Mukhebi, L. (2021). Dairy goat kids management guide. *A Publication of the Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya.* The report is available in hard copy at KALRO DRI Naivasha. 2. Waineina, R.W., Mwangi, S.I., Wasike, C.B., Kiplangat, N., Kiura, J.N. & Ilatsia, E.D. (2022). Determining the performance of different dairy goat breeds under different production systems and agro-ecological zones. *End of KCSAP dairy goat applied project report.*The report is available in hard copy at KALRO DRI Naivasha. 3. Waineina, R.W., Mwangi, S.I., Wasike, C.B., Kiura, J.N. & Ilatsia, E.D. (2022). Dairy Goat Germplasm Multiplication and Delivery to smallholder farmers. *End of KCSAP dairy goat seed system project report.* The report is available in hard copy at KALRO DRI Naivasha.

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 DRI Naivasha P.O. Box 25 -20117 Naivasha, Kenya Email: director.dri@kalro.org Tel: + 020 2390930
Lead organization and scientists	KALRO, Waineina R.W., Kiura J.N., Wasike C.B., Mwangi S.I., Mukhebi L. and Ilatsia E.D.
Partner organizations	Maseno University, Kenya livestock Breeders Associations, Dairy goat Breeders Association (DGAK, TDGBA)

RGaps

- Kid feeding schedule per breed

2.1.4 Identification and recording

2.1.4 TIMP name	**Identification and recording**
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	• RInadequate identification makes traceability of individual goats difficult due poor feed planning and management makes the goat enterprise less profitable. • Poor recording keeping
What is it? (TIMP description)	Dairy goat identification is the process of uniquely identifying a dairy goat using a permanent marking on the body of the dairy goat. Identification is done by applying ear tags and/or tattoo on the ear. Dairy goat identification is both for individual farm and for individual dairy goat within a herd. It is important to avoid permanent markings on the rest of the animal body as they may lower quality of skin at the time of slaughter. For individual dairy goat identification, animal name, animal ID and parentage data are recorded.Record keeping entails collection of relevant information. On the other hands recording entails keepin a trail of operations within a dairy goat herd. The major types of records kept include registration, breeding, production, feeding, health and finances. The records may be keep in a farm record book, on special cards or in a computer. Records are necessary for decision making on the farm.

Justification	Dairy goat identification and record keeping are important in keeping accurate account of keeping an accurate trail of operations undertaken such as breeding, feeding, treatment and vaccin and culling. Records may also come in handy in case of conflicts as they can help proof ownership. Identification records help in tracking individual dairy goat performance, economic development, or any activity relating to farm operations. Overall record assist in assessing profitability/loses (financial records) in a farm.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension, Researchers, Dairy goat breeders association, agri-preneurs
Approaches to be used in dissemination	• Public and private agricultural extension servicesFarmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Functional Dairy Goat Breeders Associations (DGBA) • Higher market prices for registered goats • Performance recording and registration of the offspring in the farms • Willing farmers ready to adopt the management practice • Availability of materials for use in identifying and keeping the records
Partners/stakeholders for scaling up and their roles	• Extension service providers (public and private) – to train farmers on various dairy goat breeds and breeding system and monitor implementation • KALRO – technology development and fine tuning, ToT, backstopping and monitor implementation • Kenya Livestock Breeders Association (KLBA) - maintain records and issue registration certificates for the animals • Dairy Goat Breeders Association (DGBA) - Maintain records and monitoring of the breeds and breeding, and marketing of breeding goats • Established multipliers in various counties – train other farmers in the lower cadres

C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri, Kakamega and Tharaka Nithi
Counties where TIMP will be upscaled	Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi
Challenges in dissemination	• Weak livestock recording and registration system • Limited access to DGBA by some goat keepers • Farmers not willing to take up the management practice • Limited skills in identification and recording • Insufficient extension publications
Suggestions for addressing the challenges	• Training in dairy goat identification and recording • Documentation of dairy goat identification and recording and knowledge sharing • Support for dairy goat recording and registration • Develop and avail extension and other dissemination materials
Lessons learned in upscaling if any	• Farmers are willing to implement dairy goat identification and recording activities
Social, environmental, policy and market conditions necessary for development and upscaling	• Identification of goats and record keeping are socially acceptable as it relates to individual property. • Good management emanating from goat identification and record keeping is environmental friendly • Identification of goats and record keeping should in conformity with the guidelines as outline in the animal identification and traceability Strategy 2020-2030, GoK, MoALD • Proper goat identification enables producers to meet market requirements.
Basic costs of the TIMP	Identification cost (ear tags) KES 70 per goat Farm record book - KES 500-700
Estimated returns when using the TIMP	TBy adhering to proper animal identification and record keeping, it is expected that farmers will experience increased economic returns arising from selling identified and registered herd. A superior cost doe KES 20,000 and Kes 15,000 for a buck
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Gender issues and concerns in dissemination, adoption and scaling up	• High illiteracy levels of women may lead to lack of poor record keeping • Women may have limited access to extension services • Women may have limited access to education, training and extension services

	• Women and youth may have limited access to land for dairy goat production • Men dominant decisions at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Identification and registration of dairy goats by women and youth will accord them higher prices • Employment opportunities exist for youths in performing the task
VMG issues and concerns in dissemination adoption and scaling up	• VMGs may also have limited access to resources such as credit, and land required for the technology • Limited awareness of the benefits of identification and recording as well as access to DGBA by the VMGs • VMGs have limited access to education, training and extension services • Due to their social status VMGs may often be excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness. • High illiteracy level of VMGs leads to lack of record keeping and poor record keeping
VMG related opportunities	• Affirmative action opportunities exist VMGS to acquire the required credit • Identification and registration of dairy goats by VMGs will accord them opportunities for fetching higher prices • Employment opportunities exist for youths in performing the task
E: Case studies/profiles of success stories	
Success stories from previous similar projects	A multiplier in Kakamega. -Keeping pure breeds (Alpine, Saanen and Toggenburg), Saanen multiplier in Nyeri
Application guidelines for users	1. Waineina, R.W., Wasike, CB, Mwangi, S.I, Kiura, J.N., Ondoro, D, Gachina, W, Wahome, C., Mukhebi, L., Nyambati, E.M. and Ilatsia E. (2021). Dairy Goat Management- Resource Book. *A Publication of the Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya.* Page 41-51. ISBN: .978-9966-30-112-3. Available in hard copies at DRI Naivasha 2. Waineina, R.W., Mwangi, S.I., Wasike, C.B., Kiplangat, N., Kiura, J.N. & Ilatsia, E.D. (2022). Determining the performance of different dairy goat breeds under different production systems and agro-ecological zones. *End of KCSAP dairy goat applied project report.* Available in hard copies at DRI Naivasha

	3. MoALD. 2020. Animal identification and traceability, 2020-2030. LITS-Strategy-Final-Draft.pdf (kilimo.go.ke)
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 DRI Naivasha P.O. Box 25 -20117 Naivasha, Kenya Email: director.dri@kalro.org Tel: + 020 2390930
Lead organization and scientists	KALRO, Waineina, R.W., Kiura, J.N., Wasike, C.B., Mwangi, S.I., Wahome, C., Mukhebi, L., Nyambati, E.M. and Ilatsia E.D.
Partner organizations	Maseno University, Kenya Livestock Breeders Association, Dairy Goat Breeders Associations (Dairy Goat Association of Kenya, Tharaka Nithi Dairy Goat Breeders Association)

RGaps

Digital recording to a centralized sever to be introduced to the multipliers for feedback mechanism

2.2. Feeds and Feeding For Dairy Goats

2.2.1 Improved Napier grass varieties (the varieties include, Kakamega 1, 2, and 3; Ouma and South Africa)

3.2.1 TIMP name	**Improved Napier grass varieties (Kakamega 1, 2, and 3; Ouma and South Africa)**
Category (i.e. technology, Innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Low productivity due to inadequate feed • High prevalence of pests and diseases in forage
What is it? (TIMP description)	These are improved Napier grass varieties which include Kak1/2/3, Ouma, and South Africa. The Napier is planted and mainly used for cut and carry for year-round feeding and silage. They are tolerant to stunting and head smut are perennial grasses. They are established and used as hedgerows in soil conservation. They produce 75% of DM of Bana grass - the conventional fodder which is susceptible to stunt and smut. Napier has a crude protein (CP) content of 7-10%.

	Napier grass Source: KALRO
Justification	Dairy cattle productivity is constrained by feed shortage. Napier grass var. Bana is the primary basal fodder in smallholder dairy systems; however, it is susceptible to head smut and stunt diseases which lower its productivity and availability. Improved Napier grass offer reliable year-round feeding and silage feed source, thereby improving dairy productivity. Stunt and head smut tolerant varieties assures supply of feed throughout the year in stunt/head smut prone areas.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy farmers, researchers, extension officers, agri-preneurs, fodder traders
Approaches used in dissemination	• Public and private agricultural extension servicesFarmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of adequate clean planting material • Attractive markets for dairy products
Partners/stakeholders for scaling up and their roles	• KALRO – Availing and multiplication of clean planting material, Training Trainers (ToTs) for backstopping and monitor implementation • Frontline extension service providers (public and private) to train farmers • Farmer groups to provide demonstration plots and management of the plots
C: Current situation and future scaling up	
Counties where already promoted if any	Laikipia, Baringo, Elgeyo Marakwet, Kakamega, Kericho, Lamu, Kajiado, Machakos, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu, West Pokot.
Counties where TIMP will be upscaled	Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri,

	Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi, Trans-Nzoia.
Challenges in development and dissemination	Inadequate clean planting materials Inadequate moisture to support growth
Recommendations for addressing the challenges	• Use of biotechnology such as tissue culture for mass production • Decentralize planting materials from KALRO centres. • Use mositure conservation techniques like tumbukiza while establishing Napier
Lessons learned if any	• There is need to involve farmer(s) groups in multiplication of clean planting materials as well as linkage to regulatory bodies.
Social, environmental, policy and market conditions necessary for development upscaling.	• Community awareness of the varieties' benefits and their willingness to adopt them • Adaptability of the varieties to prevailing local conditions • Availability of adequate disease-free planting materials. • Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community. • Good milk markets to cater for anticipated yield increases.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations.	
Basic costs	It will cost approximately KES 2 per cutting
Estimated returns	The cost of production of napier/acre/year is Kes 73,000 producing 30 Tons DM/year. A 45kg goat consumes 1.5 Kg DM/day translating to a cost of KES 4.7/day/day. A goat produces up to 2 litres of milk/day when fed napier grass alone assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is KES 120 which translates to a revenue of KES 240/day/goat giving gross margin returns of KES 235/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have limited access to land for Napier grass cultivation. • Women may have limited access to education, training and extension services. • Women may have limited access to resources such as credit, implements and inputs for Napier grass cultivation • While women and youth assist in the performance of Napier grass activities revenue from the technology is

	controlled by men, limiting women and youth access to the use of income.
Gender related opportunities	• Affirmative action opportunities exist for women and youth to acquire the required credit.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Napier grass cultivation. • VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	This technology is widely adopted in the other EAC countries like Uganda, Rwanda, Burundi and Tanzania
Application guidelines for users	1. Wamalwa, J. et al. (2013) Napier Grass Smut Disease Management for High Milk Yield 2. https://www.kalro.org/arlri/sites/default/files/smut_disease_threatyens_napier_grass_production.pdf) 3. Leaflets on stunt and smut tolerant varieties available in KALRO
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- Kitale P. O. Box 450-30200 Kitale or The Institute Director, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930,

	Email: director.dri@kalro.org
Lead organization and scientists	KALRO; F.N. Muyekho, Kabirizi J., K. Aemiro, R. Musangi, A. Nijimbere, M. Mutimura, S.Ajanga, I. Kariuki,S. Mwendia, Z.Khan, C. Midega
Partner organizations	ALRO, , MoALD

GAP

Need to continue research on new Napier grass/other fodder varieties tolerant to stunt and smut diseases.

2.2.2 Oats for dairy production in frost prone areas

2.2.2 TIMP name	**Oats for dairy production in frost prone areas**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low milk productivity due to low quality feeds in frost prone areas
What is it? (TIMP description)	Oat is a tall cereal widely grown as fodder in tropical and subtropical countries. It is a cold tolerant plant that makes good hay and grains and is often grown mixed with vetch to improve crude protein content. Oats harvested at early dough stages make excellent hay for dairy cattle. Proper sun drying at this stage will make highly palatable and nutritious feed. Oat at dough stage has a CP of 10-12%.  Oats for frost prone areas Source: KALROOl Joro Orok
Justification	Oats is a versatile, succulent, fast growing, highly palatable and nutritious forage acceptable to all types of livestock hence the need to sensitize farmers on use of oats hay in frost prone areas to mitigate feed scarcity which is the major constraint to milk production in these areas. Utilization of oats hay, increases milk yield in frost prone areas
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Small and medium scale dairy farmers, Extension service providers, Researchers, forage producers, feed and producers, agri-preneurs.
Approaches used in dissemination	• Public and private agricultural extension servicesFarmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Acceptability of oat hay by farmers for livestock feeding • Trade-off between sale of oat grain and hay • Availability of oat seed • Availability of favorable milk markets
Partners/stakeholders for scaling up and their roles	• KALRO - multiplication of clean oats seed and training of ToTs. • Frontline Extension Service Providers (public and private) – to train farmers on use of oat hay • Oat seed growers – to provide certified seed to farmers. • KEPHIS – Seed quality regulation.
C: Current situation and future scaling up	
Counties where already promoted if any	Nyandarua -KALRO - Ol Joro Orok Centre, Laikipia, Baringo, Elgeyo Marakwet, Kakamega, Kericho, Lamu, Kajiado, Machakos, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu, West Pokot
Counties where TIMP will be upscaled	Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, , Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyandarua, Vihiga, Trans-Nzoia.
Challenges in development and dissemination	Lack of awareness by farmers on conservation of good quality oats hay.
Suggestions for addressing the challenges	Training and awareness creation on utilization of oats hay as animal feed.
Lessons learned	With proper training farmers can make innovations on manual hay balers for proper storage and conservation of oats.
Social, environmental, policy and market conditions necessary for development and upscaling	• Community awareness of the varieties' benefits and their willingness to adopt them • The TIMP will be acceptable in all target communities

	• Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community. • Good milk markets to cater for anticipated yield increases.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Total cost is KES 41,000 per acre. Seed rate of 50 kg per acre
Estimated returns	The cost of production of oat grass/acre/year is Kes 41,000 producing 3 Tons DM/acre/year. A 45 kg goat consumes 1.5 kgs DM/day which costs Kes 1.4/kg DM translating to a cost of Kes 2.5/goat/day. A goat produces up to 2.1 litres of milk/day when fed oat grass alone assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is Kes 120 which translates to a revenue of Kes 252/day/goat giving gross margin returns of Kes 249/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have limited access to land for oat cultivation • Women may have limited access to education, training and extension services • Women may have less access to resources such as credit, implements and inputs for oat cultivation • While women and youth assist in the performance of oat activities revenue from the oat hay sales and livestock is controlled by men, limiting women and youth access to the use of income
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs may have limited access to land for oat cultivation. • VMGs may have limited access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs may have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit and control revenue from sale of hay and milk.

E: Case studies/profiles of success stories	
Success stories from previous similar projects	The technology has been demonstrated with success by Tulaga Dairy farmers in Nyandarua County
Application guidelines for users	Hay making pamphlets developed and available at KALRO Naiavasha and KALRO Ol Joro Orok
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930, Email: director.dri@kalro.org Centre Director, KALRO Ol Joro Orok, P.O Box 200 - 20302 Ol joro orok Email: kalrooljk@kalro.org Mobile :0719854357
Lead organization and scientists	KALRO; N.N. Kanegeni, E. Nyambati, G. Juma, Dr. J. Muia
Partner organizations	KALRO, KEPHIS, MoALD, County governments

Gaps

1. Validation of oat legume mixture in different agro-ecological zones
2. Validation of Oat based feeding regimes
3. Economic analysis of Oat based fodder
4. Economics of milk production from Oat based fodder feeding.

2.2 3 High altitude composite maize fodder

2.2.3 TIMP name	**High altitude composite maize fodder**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low milk productivity due to low quantity of feeds in high altitude/cold areas.
What is it? (TIMP description)	High altitude composite (HAC) maize is an open pollinated variety (composite) with high forage production, suitable for silage production. It can produce up to 20 tons of dry matter

	when harvested at the dough stage of growth. The variety is recommended for silage in high altitude climatic conditions. The composite also has a high grain yield potential of 20 – 34 bags per acre and is suitable for the cold highlands where common hybrid maize does not do well. It is an early maturing variety as it takes 140-160 days to reach physiological maturity. Other attributes include, tolerance to frost and foliar diseases and strong stalks.  High altitude composite maize Source: KALRO
Justification	There is inadequate fodder for silage making and green chops in the humid highlands that are characterized by low temperatures and occasional frost. This has led to low milk productivity in these areas. High altitude composite maize is adaptable to these areas and is also a high dry matter producer, thereby making it a good option for feed in the high altitude cold areas.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy farmers in high altitude areas, Extension Agents, Researchers, fodder producers, agri-preneurs and Service providers
Approaches used in dissemination	• Public and private agricultural extension servicesFarmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of seeds. • Availability of training materials.

Partners/stakeholders for scaling up and their roles	• KALRO- availing clean HAC maize seed and training. • MoALD - Farmer registration • County Governments - sensitization and mobilization of dairy farmers. • Farmers – consumer and providing land for technology validation. • KEPHIS- regulation of seed production and marketing
C: Current situation and future scaling up	
Counties where already promoted if any	Nakuru, , Laikipia, Baringo, Elgeyo Marakwet, Kericho, Nyandarua, Uasin Gishu,
Counties where TIMP will be upscaled	Meru, Bomet, Bungoma, Busia, Kericho, Kiambu, Nyeri, Kirinyaga, Kisii, Muranga, Nakuru, Nandi, Uasin Gishu, Nyandarua, Trans-Nzoia.
Challenges in dissemination	• Limited technical skills on silage making among extension staff • Inadequate extension materials and publication • High cost of polythene and other input materials
Recommendations for addressing the challenges	• Training of extension staff on silage making skills • Develop and avail extension materials such as information leaflets and manuals on silage making. • Form farmer groups for bulk buying in order to enjoy economies of scale
Lessons learned	• The the maize variey is dual-purpose and can used as food and feed for livestock thus reducing human-animal grain conflicts • Grain or bran can be used for feed formulation
Social, environmental, policy and market conditions necessary for development and upscaling	• Community awareness of the varieties' benefits and their willingness to adopt them • The established of maize for fodder has little negative effects on the environment • Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community. • A lot of milk is produced throughout the year to meet the demand.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The basic costs for producing 1 kg of HAC maize seed is KES 215
Estimated returns	The cost of production of maize silage /acre/year is Kes 150,000 producing 12 Tons DM/year. A 45 kg a goat consumes 1.5 Kg DM/day which costs KES 12/kg translating to a cost of KES 24.4/goat/day. A goat produces up to 2 litres

	of milk/day when fed maize silage alone assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is KES 120 which translates to a revenue of KES 240/day/goat giving gross margin returns of KES 215/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have limited access to land for high altitude composite maize fodder cultivation. • Women may have limited access to education, training and extension services. • Women may have less access to resources such as credit, implements and inputs for maize cultivation • While women perform most activities on maize production men dominate decision on livestock revenue utilization at the household level.
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs may have limited access to land for maize cultivation. • VMGs may have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs may have limited access to education, training and extension services, • Due to their social status VMGs may often be excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness.
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Dairy farmers and cooperatives (Tulaga and Nyala dairy farmers cooperative) in Nyandarua and Laikipia have successfully made silage from this HAC variety that has successfully impacted their dairy enterprises
Application guidelines for users	Farmer leaflet are available in hard copies at KALRO Ol Joro Orok Centre
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, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930, Email: director.dri@kalro.org Or Centre Director, KALRO Ol Joro Orok, P.O Box 200 - 20302 Ol joro orok Email: kalrooljk@kalro.org Mobile :0719854357
Lead organization and scientists	KALRO; N.N. Kanegeni, Dr. E. Nyambati, G. Juma ,Dr. J. Muia
Partner organizations	KALRO Ol Joro Orok, KALRO Kitale, MoALD, KEPHIS

Gaps

1. Validation of HAC maize fodder in different agro-ecological zones
2. Validation of HAC maize fodder-based feeding regimes
3. Economics of milk production from HAC maize fodder for green chop or silage feeding.

2.2.4 Fodder sorghum (Sorghum bicolor) variety E6518

2.2.4 TIMP name	**Fodder sorghum (*Sorghum bicolor*) variety E6518**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low milk productivity due to low quantity of feeds as result of lack of or unreliable rains
What is it? (TIMP description)	Fodder sorghum variety E6518 is drought tolerant high yielding and produces brown grain. It is dual purpose as it produces grain and high quality fodder. Although it is drought tolerant, is well suited to grow in areas with altitude of 750-2300 m.a.s.l. The variety takes 6 months to grain maturity.It can be harvested for fodder at about 4 months when it is hard dough stage. It is possible to get two economically viable rattoons after planting.
Justification	Feed scarcity is common occurrence to dairy farmers both in the ASALs and high rainfall areas. This is a major challenge to milk production hence income, among dairy producers. E6518 sorghum as a drought tolerant high yielding, brown grain sorghum with dual purpose for grain and high quality fodder is

	an ideal crop for silage making and hence meeting the challenges of feed scarcity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy farmers, silage makers and sellers, Extension Agents, Service providers, agri-preneurs, Feed producers
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services • Field days, posters, brochures, pamphlets, demonstrations
Critical/essential factors for successful promotion	• Availability of seed • Training of farmers on management and utilization of sorghum
Partners/stakeholders for scaling up and their roles	• KALRO - Availing clean seed, training and research • MoALD and County Governments- Sensitization and mobilization of dairy farmers. • KEPHIS- quality seed regulation.
C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri, Kakamega, Bomet, Busia and Kericho Laikipia, Baringo, Elgeyo Marakwet, Machakos, Lamu, Kajiado, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu, West Pokot
Counties where TIMP will be upscaled	Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi, Trans-Nzoia.
Challenges in development and dissemination	• Limited technical skills on propagation and utilization of E6518 sorghum • Unavailability of adequate E6518 sorghum seed • Inadequate extension materials and publications on E6518 sorghum
Suggestions for addressing the challenges	• Training of extension officers and farmers • Improving seed access and information sharing

	• Involving forage private seed producers in bulking clean E6518 • Availing adequate extension materials and publications
Lessons learned	• Bulking can improve seed availability. • Management of rattoon crops to reduce cost of production
Social, environmental, policy and market conditions necessary for development and upscaling	• Community awareness of the varieties' benefits and their willingness to adopt them • The fact that sorghum E6518 can be rattooned two times helps conserves the soil by reducing tilling • Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community. • Good milk prices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	C The seed rate is 5 kg per acre @ KES 350 Seed cost per acre is KES 1750.
Estimated returns	The cost of production of sorghum/acre/year is KES 52,000 producing 12 Tons DM/year. A 45 kg goat consumes 1.5 kg DM/day which costs KES 1.6/kg translating to a cost of KKES 3/goat/day. A goat produces up to 2 litres of milk/day when fed sorghum green chop alone assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is Kes 120 which translates to a revenue of Kes 240/day/goat giving gross margin returns of Kes 337/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have limited access to land for sorghum cultivation. • Women may have limited access to education, training and extension services. • Women may have limited access to resources such as credit, implements and inputs for sorghum cultivation • While women perform most activities on sorghum production men dominate decision on livestock revenue utilization at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit as well knowledge sorghum production.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs may have limited access to land for maize cultivation. • VMGs may have less access to agricultural information, technology and knowledge.

	• VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs may have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories	Dairy farmers and cooperatives in Nyandarua and Nakuru have successfully made silage from this fodder sorghum Variety that has positively impacted their dairy enterprises
Application guidelines for users	1. Muyekho, F.N. (2017) Grow Fodder Sorghum For Increased Milk Yield (Brochure) 2. https://www.kalro.org/sites/default/files/Grow-fodder-sorghum-for-increased-milk-Dec2020.pdf
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, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930, Email: director.dri@kalro.org Centre Director, KALRO Ol Joro Orok, P.O Box 200 - 20302 Ol joro orok Email: kalrooljk@kalro.org Mobile :0719854357
Lead organization and scientists	N.N. Kanegeni, E. Nyambati, J. Muia, I. Tura and J. Ouida KALRO Ol Joro Orok
Partner organizations	KALRO Ol Joro Orok, KALRO Lanet, MoALD, KEPHIS.

Gaps

1. Validation of fodder sorghum in different agro-ecological zones
2. Validation of fodder sorghum-based feeding regimes
3. Economic analysis of Sorghum-based silage feeding
4. Economics of milk production from Sorghum-based silage.

2.2.5 Improved Brachiaria grass varieties

2.2.5 TIMP name	Improved Brachiaria grass varieties
Category (i.e. Technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low milk productivity due to scarcity/unavailability of productive and high-quality forages to bridge livestock feed deficit.
What is it? (TIMP description)	Brachiaria is a high yielding grass with good adaptability of different environments, particularly the warm medium altitude and coastal lowlands. It can be used as cut-and-carry, grazed or conserved as hay or silage and is a good alternative grass to the common Napier grass which is susceptible to head smut and stunting diseases. Improved Brachiaria grass cultivars in Kenya include: *Brachiaria Brizantha cv.* Piata, *Brachiaria decumbence cv.* Basilisk, *Brachiaria Brizantha cv.* MG4, *Brachiaria Brizantha cv.* Xaraes *and Brachiaria Brizantha cv.* Marandu. Brachiaria has a CP of 12-16% and can produce 6-12 t/ha DM per year.  Bracharia grass  Brachiaria grass seeds Source: KALRO
Justification	Brachiaria grasses a native of eastern Africa, which has been widely adapted as livestock feed in South America and East Asia. It is palatable and nutritious with crude protein of up to 16%. Besides their use as livestock feed, Brachiaria is known to contribute to carbon sequestration, ecological restoration

	and soil erosion control and hence play an important role in reducing greenhouse gasses and nutrient losses from soil.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Private and public extension service providers, smallholder dairy farmers, researchers, agri-preneurs, fodder and feed producers.
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services • Public and private agricultural extension services
Critical/essential factors for successful promotion	• Acquisition and availing demonstration material such as planting materials • Development of information materials such as farmers' leaflets and booklets
Partners/stakeholders for scaling up and their roles	• KALRO-Avail the planting material and training. • Universities-Technical backstopping and research services • National and County Ministry of Agriculture, Livestock Development – organize farmer groups, mobilize farmers and facilitate farmer trainings • Kenya Plant Health Inspectorate Services (KEPHIS)-Seed inspection • CBOs, NGOs- Seed multiplication and technology dissemination • Processors: Create demand for variety • Farmers: Test/validate and produce • CGIARS e.g. IITA: Funding and technical back stopping
C: Current situation and future scaling up	
Counties where already promoted if any	Lamu, Taita Taveta, Kilifi and Kwale, Machakos, Makueni, Kitui, Kakamega, Vihiga, Bungoma, Busia, Laikipia, Baringo, Elgeyo Marakwet, Kericho, Kajiado, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu and West Pokot.

Counties where TIMP will be upscaled	Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi, Trans-Nzoia.
Challenges in dissemination	• High cost of brachiaria seed since it is imported. • Limited knowledge on agronomic practices for bracharia • Inadequate Extension services and awareness
Recommendations for addressing the challenges	• Use of Brachiaria root splits as planting material • Capacity building on necessary agronomic practices for bracharia • County Governments to partner with farmer groups and NGOs for extension and awareness.
Lessons learned	• Farmer demand for the planting materials is high • Brachiaria does well in fertile soils • Brachiaria flowers well and forms spikelets, but the seeds are not viable. • but the usUse of root splits for propagation of bracharia is very successful
Social, environmental, policy and market conditions necessary	• Farmers willingness to adopt the technology. • Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community. • Favourable weather conditions. • Organized markets with favourable pricing policy to encouraging producers • Good markets for milk and brachiaria hay.
D: **Economic, gender, vulnerable and marginalized groups (VMGs) considerations**	
Basic costs	I kg bracharia seed is KES 4450
Estimated returns	The cost of production of brachiaria /acre/year is Kes 150,000 producing 12 Tons DM/year. A 45 kg goat consumes 1.5 kgs DM/day which costs Kes 13.6/kg translating to a cost of Kes 26/goat/day. A goat produces up to 2 litres of milk/day when fed brachiaria alone assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is Kes 120, which translates to a revenue of Kes 240/day/goat giving gross margin returns of Kes 213/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have limited access to land for Brachiaria grass cultivation.

	• Women have limited access to education, training and extension services. • Women may have limited access to resources such as credit, implements and inputs for Brachiaria grass cultivation • While women may perform most activities on Brachiaria grass production men dominate decision on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Business opportunity exist for youth to rent land grow brachiaria grass and sell the splits to other farmers as well as hay.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs may have limited access to land for Brachiaria grass cultivation. • VMGs may have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs may have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit as well as information and knowledge.
E: Case studies/profiles of success stories	
Success stories	The technology has been successfully adopted by dairy farmers groups in Kieni, Nyeri County resulting in improved income generation.
Application guidelines for users	1. Muyekho, F.N. (2017) Grow Brachiaria in Drier Areas for Livestock Feed available in hard copy 2. https://www.kalro.org/oldsite/sites/default/files/Grow-Brachiaria-in-Drier-Areas-Dec2020.pdf 3. Njarui, D.M.G (2016) Climate Smart Brachiaria Grasses for Improving Livestock Production in East Africa – Kenya Experience. Proceedings of the worKesop held in Naivasha, Kenya, 14 - 15 September, 2016. https://www.kalro.org/sites/default/files/Proceeding-Climate-Smart-Brachiaria-Grasses-Dec2016.pdf 4. Brachiaria Brochure available in KALRO

F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for Upscaling.
G: Contacts	
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Lead organization and scientists	KALRO Katumani and KALRO Naivasha institutes Donald Njarui, E. Nyambati, N. Kanegeni, N. Ondabu and W. Ayako
Partner organizations	KALRO, KEPHIS , BeCA ILRI, County Governments, MoALD

Gaps

1. Need to identify niches for Brachiaria seed production
2. Need for Brachiaria National Performance Trial for seed certification and commercial release
3. Research on identification of newer varieties, carrying capacity, persistence under cut and carry and grazing regimes
4. Validation on the Brachiaria-based feeding regimes for dairy cattle
5. Economic analysis of Brachiaria grass production
6. Economics of milk production from Brachiaria based feeding regimes.

2.2.6 Common vetch (Vicia sativa) fodder

2.2.6 TIMP name	**Common vetch (*Vicia sativa)* fodder**
Category (i.e. technology, innovation or management practice)	Technology

A: Description of the technology, innovation or management practice	
Problem to be addressed	Low milk productivity due to inadequate quality of feeds particularly lack of protein in feeds in frost prone areas
What is it? (TIMP description)	Vetch is a climber legume that grows well in association with grasses to produce a mixed ley for grazing and silage making. It grows in 2190 - 2280 m.a.s.l. in lower highlands 5 (LH5) with average annual rainfall of 800-900 mm. Temperature range is 4.3-21.1^{o}C. Best soils are non-acidic sandy or sandy loam. Vetch can grow in all types of soils unless they are alkaline or waterlogged. CP of vetch is 15-22%.  Common vetch Source: KALRO
Justification	Low protein in dairy animal feed can cause significant reduction in milk productivity. Common vetch has high CP of above 20% and is highly acceptable as grazed or conserved forage which can to alleviate the low protein levels in feeds. It is persistent and a prolific seeder withstanding competition from grasses
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Private and public extension service providers, smallholder dairy farmers, researchers, fodder, agri-preneurs and feed producers.
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services • Public and private agricultural extension services
Critical/essential factors for successful promotion	• Attractive milk market for small scale farmers. • Availability of seed for farmers.

Partners/stakeholders for scaling up and their roles	• KALRO-Avail the planting material, trainings and technical backstopping • County Governments and Ministry of Agriculture Livestock development- organize farmer groups and train farmers • Kenya Plant Health Inspectorate Services (KEPHIS) - Seed inspection and regulation. • CBOs, NGO's- Seed multiplication and technology dissemination • Farmers: Test/validate and produce seed.
C: Current situation and future scaling up	
Counties where already promoted if any	aikipia, Baringo, Elgeyo Marakwet, Machakos, Kakamega, Kericho, Lamu, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu, West Pokot
Counties where TIMP will be upscaled	Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi, Trans-Nzoia
Challenges in dissemination	• Inadequate Extension services and awareness • Vetch seed unavailability.
Recommendations for addressing the challenges	• County Governments to partner with farmer groups and NGOs for extension and awareness • Work closely with farmer groups in seed bulking
Lessons learned	• Has fast and vigorous growth habit, smothers weeds and saves on labour for weeding • Flowers and seed early • Prolific in seed production • High biomass production
Social, environmental, policy and market conditions Necessary for development and upscaling	• Willingness of farmers to adopt the technology • Favourable weather conditions for growth of crop • Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community. • Favourable policies to support seed production and dissemination • Attractive milk market for small scale farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	CPrice of 1 kg of vetch is 1000
Estimated returns	The cost of production of vetch/acre/year is KES 67,000 producing 3 Tons DM/year. A 45 kg goat consumes 0.5ks DM/day as supplement which costs Kes 22/kg translating to a cost of KES 14.5/goat/day. A

	goat increases production by 1 litres of milk/day when fed on vetch as supplement assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is Kes 120 which translates to a revenue of Kes 120/day/goat giving gross margin returns of Kes 105/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have less access to land for Common vetch cultivation. • Women have limited access to education, training and extension services. • Women have less access to resources such as credit, implements and inputs for Common vetch cultivation • While women perform most activities on Common vetch production men dominate decision on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit as well knowledge and information.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Common vetch cultivation. • VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit, knowledge and information.
• E: Case studies/profiles of success stories	
Success stories	1. Ikinyukia Self Help group (composed of 20 members) in Nyandarua County sold vetch seeds and hay worth KES 3,062,000 (USD 34,022) over a one-and-a-half- year period. 2. High demand of Vetch planting materials by farmers
Application guidelines for users	Lukuyu, B.A., Muriuki, L. and Lukuyu, M. (2008) Using vetch to feed livestock (Brochure), vetch production brochure available at KALRO Ol Joro Orok.

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, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930, Email: director.dri@kalro.org Or Centre Director, KALRO Ol Joro Orok, P.O Box 200 - 20302 Ol joro orok Email: kalrooljk@kalro.org Mobile :0710854357
Lead organization and scientists	N.N Kanegeni, E. Nyambati, J. Muia, G. Juma and N. Ondabu
Partner organizations	KALRO, MoALD, KEPHIS

Gaps

1. Need for National Performance Trials for Common vetch *(Vicia sativa)* seed certification and commercial release
2. Further research required for intercropping with fodder grasses
3. Validate the inclusion and substitution levels
4. Economic analysis of common vetch forage and seed production
5. Economics of milk production from Vetch based feeding regimes.

2.2.7 Desmodium (Desmodium intortum) - Napier grass intercrop

2.2.7 TIMP name	**Desmodium *(Desmodium intortum)*- Napier grass intercrop**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low milk production due to low quality of feeds
What is it? (TIMP description)	Desmodium is a protein rich creeping forage legume. It can be intercropped with Napier grass to improve the nutritive value of Napier fodder. The mixture of Napier grass and Desmodium increases biomass yield by about 30% and improves the

	nutritive value of the feed and feed utilization efficiency thereby increasing milk production  Napier grass and Desmodium intercrop Source: KALRO
Justification	Feeding dairy goats on Napier grass alone is not enough to attain their production potential.. They require supplementation with a high protein feed supplement. Desmodium is a cheaper supplementation option available for dairy farmers. Feeding dairy goats on Napier grass-Desmodium intercrop increases milk production as compared to feeding Napier grass alone.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy farmers, researchers, fodder and feed producers, private & public extension service providers and Agri-preneurs.
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Availability of clean planting material • Use of appropriate promotion methods • Involvement of all dairy stakeholder in the promotion process
Partners/stakeholders for scaling up and their roles	• KALRO-avail planting material and technical backstopping • Universities-technical backstopping and research services

	• Ministry of Agriculture and Livestock Development- Policy formulation, setting of standards and trainings • County governments - mobilize farmer groups and provide extension service • Kenya Plant Health Inspectorate Services (KEPHIS)- seed inspection • CBOs, NGO's-seed multiplication and technology dissemination • Processors-create demand for variety • Farmers-test/validate and produce
C: Current situation and future scaling up	
Counties where already promoted if any	Laikipia, Baringo, Elgeyo, Marakwet, Machakos, Kakamega, Kericho, Lamu, Kajiado, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu, West Pokot.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• High cost of desmodium seed. • High cost of labour especially at establishment • Lack of awareness of napier grass and desmodium intercrop • Inadequate extension services by County Governments • Poor perception towards new legume/fodder/grass varieties
Recommendations for addressing the challenges	• Avail desmodium vines for establishment as a cheaper alternative to reduce cost. • Training and capacity building for farmers • County governments to liaise with farmer groups and private extension agents for extension services • Campaign for attitude change
Lessons learned	The intercrop improves yields and quality of grass fodder
Social, environmental, policy and market conditions necessary for development and upscaling	• Willingness of farmers to adopt the technology • Favourable weather conditions or crop growth • Favourable policies to support seed/production, marketing and value addition • Attractive milk market
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The seed rate for desmodium is 3 kg/acre and the number of cuttings/acre required is KES 8,000.
Estimated returns	The cost of production of napier-desmodium/acre/year is KES 49,000 producing 45 Tons of dry matter (DM) /year. A 45 kg goat consumes 1.5 kg of DM/day which cost KES 1 per kg translating to a cost of KES 3/goat/day. A goat produces up to 2.5 litres of milk/day when fed napier grass-desmodium intercrop assuming that

	the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is KES 120 which translates to a revenue of KES 300/day/goat giving gross margin returns of KES 7/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for Desmodium napier grass intercrop cultivation • Women have limited access to education, training and extension services • Women have less access to resources such as credit, implements and inputs for Desmodium napier grass intercrop cultivation • While women perform most activities on Desmodium napier grass intercrop, they may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit, knowledge and information • High yields will offer opportunities and encourage commercialization thus attract women and youth in dairy industry
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs may have limited access to land for Desmodium napier grass intercrop cultivation. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs may have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness as a result of limited access to agricultural information, technology and knowledge
VMG related opportunities	• Opportunities for funds provision from the government through affirmative action exist for VMGs e.g. the youths' funds and the women enterprise fund • Increased production will lead to increased consumption and utilization of of dairy products and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	Increased income from use of the technology by Githunguri dairy goat farmers (Mihuko and Thakwa high breeders) in Kiambu County and Bahati farmers (Mwangaza, Ariithi and Ngecha) in Nakuru County.
Application guidelines for users	Technical bulletin and farmer leaflets containing instructions on how to apply the technology.

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, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930, Email: director.dri@kalro.org
Lead organization and scientists involved in development/validation	KALRO DRI –Naivasha and Ol Joro Orok, KALRO FCRI-Muguga and Kitale N. Kanegeni, W. Ayako, I. Kariuki and E. Nyambati.
Partner organizations involved in development/validation	KALRO, KEPHIS, MoALD

Gaps:

1. Need for research on cutting frequency and persistence of Napier Desmodium intercrop
2. Economic analysis of Desmodium forage and seed production
3. Economics of milk production from Desmodium based feeding regimes

2.2.8 Tree Lucerne or Tagasaste- (*Chamaecytisus prolifera*)

2.2.8 TIMP name	**Tree Lucerne or Tagasaste- *(Chamaecytisus prolifera)***
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low milk productivity due to low quality feeds.
What is it? (TIMP description)	Tree Lucerne is a perennial legume shrub rich in crude protein that grows in medium warm altitudes and cold highlands (1500-2500 m.a.s.l with 600 -1600 mm of rain annually. It can grow in all types of soil except in waterlogged conditions. It can be established as an alley crop with other food crops or as a hedge (live fence). The soft growths or twigs can be cut and fed to livestock to bridge the protein gap in the dairy goat diet. Tree Lucerne has Crude Protein (CP) of 18-28%.

	 Tree Lucerne Source: KALRO
Justification	Low milk productivity due to low quality feeds is common in dairy farms. Tree Lucerne is a nitrogen fixing plant with leaves that have high protein content. Thus, it is a multipurpose tree that can be used both as a fodder and a hedge. The leaf meals can be fed directly to animals or in feed compounding.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy farmers, extension agents, researchers and agri-preneurs
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Availability of tree Lucerne seeds and seedlings • Use of appropriate promotion methods • Involvement of all dairy stakeholder in the promotion process
Partners/stakeholders for scaling up and their roles	• KALRO-avail planting material and technical backstopping • Universities-technical backstopping and research services • Ministry of Agriculture and Livestock Development-Policy formulation, setting of standards and trainings • County governments - mobilize farmer groups and provide extension service • Kenya Plant Health Inspectorate Services (KEPHIS)- seed inspection

	• CBOs, NGO's-seed multiplication and technology dissemination • Processors-create demand for variety
C: Current situation and future scaling up	
Counties where already promoted if any	Laikipia, Baringo, Elgeyo Marakwet, Machakos, Kakamega, Kericho, Lamu, Kajiado, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu and West Pokot.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi
Challenges in development and dissemination	• Unavailability tree lucerne seed. • High cost of labour especially at establishment • Low awareness levels on benefits of using tree lucerne
Recommendations for addressing the challenges	• Bulking of tree Lucerne seed through farmer groups to increase access to seed • Awareness creation using publications-posters/brochures/leaflets, manuals
Lessons learned	• County governments can partner with farmer groups and NGOs for extension and awareness.
Social, environmental, policy and market conditions necessary for development and upscaling	• Willingness of farmers to adopt the technology. • Favourable weather conditions • Availability of information on seed quality • Attractive milk market
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The basic cost of producing leaf meal from 1 acre is KES 75,000.
Estimated returns	The cost of production of tree Lucerne/acre/year is KES 75,000 producing 4 Tons of dry matter (DM)/year. A 45 kg goat consumes 0.5 kg DM/day as a supplement which costs KES 19/kg translating to a cost of KES 12.2/goat/day. A goat increases production by 1 litre of milk/day when fed on Tree Lucerne as supplement assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is KES 120 which translates to a revenue of KES 120/day/goat giving gross margin returns of KES 107.8/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for Tree Lucerne cultivation. • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services.

	• Women have limited access to resources such as credit, implements and inputs for Tree Lucerne cultivation • While women perform most activities on Tree Lucerne, they may not be involved in decision on livestock production and marketing at the household level
Gender related opportunities	Affirmative action opportunities exist for women and youths to acquire the required credit, knowledge and information.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Tree Lucerne cultivation. • VMGs have limited access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. . • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit, knowledge and information.
E: Case studies/profiles of success stories	
Success stories	Increased incomes for members of Ikinyukia Self Help group in Kinangop and individual farmers in Nakuru and Nyandarua Counties involved in seed bulking and forage production.
Application guidelines for users	Farmer pamphlets and leaflets available at KALRO - Ol joro Orok Centre.
F: Status of TIMP readiness 1. Ready for upscaling; 2. Requires validation; 3. Requires further research	Ready for up scaling
G: Contacts	
Contacts	The Institute Director, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930, Email: director.dri@kalro.org
Lead organization and scientists	KALRO - Ol Joro Orok, N.N. Kanegeni, G. Juma and E. Nyambati.
Partner organizations	KALRO, MoALD, KEPHIS.

Gap:

1. National Performance Trials (NPT) for Tree Lucerne/ tagasaste seed certification and commercial release
2. Validate harvesting management for leaves and twigs
3. Validate the inclusion and substitution levels in dairy rations
4. Economic analysis of fodder tree forage Lucerne and seed production
5. Economics of milk production from fodder tree Lucerne based feeding regimes.

2.2.9 Sweet Lupin (*Lupinus albus* and *Lupinus angustifolius*)

2.2.9 TIMP name	**Sweet Lupin (*Lupinus albus* and *Lupinus angustifolius*.)**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low milk yields due to low quality feeds
What is it? (TIMP description)	Lupins are legumes whose grains are rich in crude protein (CP) of 26-36% and is an ingredient in animal feed formulations and the waste is plowed back to increase soil fertility. There are two common varieties in Kenya: the broad leaved and narrow leaved. Some of the common varieties include *Lupinus albas* cv ultra, *Lupinus albas* cv kieve mutant, *Lupinus angustifolius* cv 28137, 28324. It is excellent in crop rotation with grasses and cereal crops. It grows in all types of soil but is sensitive to low soil pH. The dry beans are harvested and ground and mixed with maize meal in the ratio of 1 part lupin: 3 parts Maize meal to make a dairy goat feed supplement. The supplement is fed to milking goats at the rate of 1 kg to every 2 kg of milk.  Sweet Lupin at pod stage Source: KALRO
Justification	Dairy meal as a supplement for dairy cattle is very expensive for farmers. The use of lupin/maize meal will reduce the cost of dairy supplementation and increase milk production. The high crude protein in Lupins makes it suitable for use as an ingredient in feed formulation. In addition, the crop fixes nitrogen and helps in management of soil erosion.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy farmers, extension Agents, researchers, seed Companies and agri-preneurs.

Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Availability of lupin seed and grain for feed formulation. • Feed formulation skills
Partners/stakeholders for scaling up and their roles	• KALRO-avail planting material and technical backstopping • Universities-technical backstopping and research services • Ministry of Agriculture and Livestock Development-Policy formulation, setting of standards and trainings • County governments - mobilize farmer groups and provide extension service • Kenya Plant Health Inspectorate Services (KEPHIS)-seed inspection • CBOs, NGO's-seed multiplication and technology dissemination • Processors-create demand for variety • Farmers-test/validate and produce
C: Current situation and future scaling up	
Counties where already promoted if any	Laikipia, Baringo, Elgeyo Marakwet, Machakos, Kakamega, Kericho, Lamu, Kajiado, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu, West Pokot.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in development and dissemination	• Low farmer awareness of lupin potential as concentrate feed • Unavailability of seed. • Lack of knowledge for feed formulation
Recommendations for addressing the challenges	• Training and seed bulking by farmer groups.

Lessons learned	• There is need to supply enough seed and sensitize farmers on the potential lupin has as a feed ingredient for the success of the technology.
Social, environmental, policy and market conditions necessary	• Willingness of farmers to adopt the technology • Favourable weather conditions • Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community • Attractive milk market for small scale farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	It will cost about KES 75,000 per acre- (12 Kg of seed is required for establishment of 1 acre)
Estimated returns	The cost of production of lupin/acre/year is KES 75,000 producing 1 Tons DM/year. A 45 kg goat consumes 0.5kgs DM/day as supplement which costs KES 59/kg translating to a cost of KES 38.4/goat/day. A goat increases production by 1 litre of milk/day when fed on lupin as supplement assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is KES 120 which translates to a revenue of KES 120/day/goat giving gross margin returns of KES 81.7/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for Sweet Lupin cultivation • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services • Women have limited access to resources such as credit, implements and inputs for Sweet Lupin cultivation • While women perform most activities on Sweet Lupin, they may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit, knowledge and information.

VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Sweet Lupin cultivation. • VMGs have limited access to agricultural information, technology and knowledge • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit, knowledge and information.
E: Case studies/profiles of success stories	
Success stories	Increased incomes for Ikinyukia Self Help Group in Nyandarua County doing Lupin production for sale and feeding animals.
Application guidelines for users	Technical bulletin and farmer leaflets containing instructions on how to apply the technology
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, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930, Email: director.dri@kalro.org
Lead organization and scientists	KALRO DRI- Ol Joro Orok N.N. Kanegeni, E Nyambati, T. Onyango, G. Juma and J Muia.
Partner organizations	KALRO, KEPHIS and MoALD.

Gaps

1. Validation of new sweet lupin *(Lupinus albus and Lupinus angustifolius)* varieties for feed rations
2. NPT for seed certification and commercial release
3. Economic analysis of Lupin grain and seed production
4. Economics of milk production from Lupin grain-based feeding regimes.

2.2.10 Fodder Sweet potato vines (*Ipomoea batatas*)

2.2.10 TIMP name	**Fodder Sweet potato vines** *(Ipomoea batatas)*
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low milk production in due to low quality dairy cattle feeds.
What is it? (TIMP description)	Fodder sweet potato vines (SPV) are succulent creepers that have edible tubers which form the roots. They are easily established and the vines are used to feed livestock. The vines are rich in crude protein (CP is 12.5-15%) and are highly digestible, hence very good supplement for dairy goats on grasses and maize silage.  Sweet Potato Vines Source: KALRO
Justification	Poor feed quality is a major challenge to increased milk production to most smallholder dairy farmers. SPV are perennial and persistent if the tubers are not uprooted. They are prolific and regrow quickly after harvesting the vines. The high CP improves the feeding value of grass when fed as a mixture, improving the milk production of dairy cows.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy farmers, extension agents, researchers, service providers, Seed Companies, agri-preneurs
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals

Critical/essential factors for successful promotion	• Availing of fodder SPV cuttings for planting • SPV requires adequate water for optimum production
Partners/stakeholders for scaling up and their roles	• KALRO-availing planting materials, Training of Trainers (ToT), backstopping and monitor implementation • Extension service providers (public and private)-training of farmers on SPV production and management • Farmer groups – provide land and manage demonstration sites
C: Current situation and future scaling up	
Counties where already promoted if any	Laikipia, Baringo, Elgeyo Marakwet, Machakos, Kakamega, Kericho, Lamu, Kajiado, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu, West Pokot.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in development and dissemination	• Low farmer awareness of potential of SPV as supplemental fodder to grasses • Inadequate extension services • Lack of SPV planting materials
Recommendations for addressing the challenges	• Farmer training on production and use of fodder SPV as feed supplement • Availing of planting SPV to the farming communities • County governments to liaise with farmer groups and private extension providers for extension services
Lessons learned	There is need to supply enough planting material and sensitize farmers on SPV potential as supplemental fodder to grasses and silages.
Social, environmental, policy and market conditions necessary development and upscaling	• Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community • Good milk markets to cater for anticipated yield increases
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About KES 90,000 for initial establishment per acre (16,000 vines @ KES 3).
Estimated returns	The cost of production of SPV/acre/year is KES 90,000 producing 4 Tons DM/year. A 45 kg goat consumes 0.5 kg DM/day as suppliment which costs KES. 22.5/kg translating to a cost of KES 14.6/goat/day. A goat increases production by 1 litre of milk/day when fed on spv as suppliment assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is

	KES120 which translates to a revenue of KES120/day/goat giving gross margin returns of KES 105.4/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for SPV cultivation • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services • Women have limited access to resources such as credit, implements and inputs for SPV cultivation • While women perform most activities on SPV cultivation, they may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	Affirmative action opportunities exist for women and youths to acquire the required credit, knowledge and information.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for SPV cultivation • VMGs have limited access to agricultural information, technology and knowledge • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit, knowledge and information.
E: Case studies/profiles of success stories	
Success stories	• Increased incomes for dairy farmers in Kinangop in Nyandarua County using SPV as a feed supplement • SPV has been used by KALRO KIBOKO for demonstration in Narok and Taita-taveta counties with an increased request for planting materials from this counties
Application guidelines for users	Pasture and fodder farmer booklet available at KALRO Ol joro orok.
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, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930,

	Email: director.dri@kalro.org
Lead organization and scientists	KALRO Ol Joro Orok: N.N. Kanegeni, J. Munyasia, E. Nyambati, J Muia, G. Juma, W. Ayako, E. Mukisira
Partner organizations	KALRO and MoALD

Gaps:

1. Validate the inclusion and substitution levels of SPV in dairy diets
2. Economic analysis of SPV forage
3. Economics of milk production from SPV-based feeding regimes.

2.2.11 Cassava-based Napier grass silage

2.2.11 TIMP name	**Cassava-based Napier grass silage**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low milk production during the dry season due to feed scarcity.
What is it? (TIMP description)	Cassava-based Napier grass silage is a basal diet conserved towards the end of the wet season for use during the dry season when forage production is low. It is mainly used as a mixture of; wilted chopped Napier grass, wilted cassava leaves and dry or fresh chopped cassava tubers in the ratio of 70:25:5. The mixture is fermented under anaerobic conditions for at least six weeks and can be ensiled in a pit or small airtight container/bag. This silage can be used as a total ration without additional supplementation because its protein content is above 16%. It should however be fed after milking to avoid milk tainting.  Cassava-based Napier grass silage making Source: KALRO
Justification	Smallholder farmers in Kenya mainly depend on forages to feed livestock. Forage is plenty during the rainy season and scarce during the dry season and this has an effect on milk yields. Preservation of surplus has the potential for increasing or stabilizing milk production and the cassava-based silage is

	an option for providing high quality feed for the dry season. The technology is based on use of unmarketable cassava roots and leaves which are not used for human consumption and would otherwise go to waste.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small and medium scale dairy farmers, extension agents, researchers, agri-preneurs
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Reliable milk markets and favourable prices • Suitable high yielding Napier grass and cassava varieties
Partners/stakeholders for scaling up and their roles	• KALRO- training of Trainers' (ToT), backstopping and monitor implementation • Extension service providers (public and private) – to train farmers on silage making • Farmer groups – provide land and manage demonstration sites
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Laikipia, Baringo, Elgeyo Marakwet, Machakos, Kakamega, Kericho, Lamu, Kajiado, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu, West Pokot
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in development dissemination	• Inadequate skills in silage preparation • Low technology awareness levels
Recommendations for addressing the challenges	Capacity building of the service providers who will train farmers on how to make cassava-based Napier grass silage.
Lessons learned	• Cassava tubers (fresh or dry) can replace molasses in silage making • Farmers who used cassava-based Napier grass silage never experienced devastating effects of drought and they sustained milk production
Social, environmental, policy and market conditions	• Reliable markets and stable milk prices

necessary development and upscaling	• Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community • Premium milk prices during the dry season to cover for cost of silage making
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production for 1 kg silage ranges from KES 5 – 10 for silage made in a pit.
Estimated returns	The cost of production of silage/acre/year is KES 55,000 producing 5.5 Tons DM/year. A 45 kg goat consumes 1.5 kg DM/day translating to a cost of KES 20/goat/day. A goat produces up to 3 litres of milk/day when fed silage alone assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is KES 120 which translates to a revenue of KES 360/day/goat giving gross margin returns of KES 340/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for cassava and napier cultivation • The technology is labour intensive and may not be adopted by women who are already overburdened with other activities such as domestic, care and other productive activities • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services • Women have less access to resources such as credit, implements and inputs for cassava based napier grass silage cultivation • Women may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Employment opportunities for youths exist in performing the task
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for cassava and napier grass cultivation • VMGs have limited access to agricultural information, technology and knowledge • VMGs have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to education, training and extension services

	• Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit. • Employment opportunities for youths exist in performing the task
E: Case studies/profiles of success stories	
Success stories	Kakuyuni, Malindi - Farmers improved milk production substantially after feeding cattle with cassava-based Napier grass silage.
Application guidelines for users	• Leaflet on silage making (English and Kiswahili) • Cassava-based Napier grass silage technologies manual (Both available on KALRO website)
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 Mtwapa PO BOX 16 – 80109. MTWAPA (K)
Lead organization and scientists	KALRO - Mtwapa Rahab Muinga; Kadenge Lewa; H. Mkuzi Saha, L. Mambo
Partner organizations	Pwani University, CBOs, DLPOs (Kwale, Kilifi and Malindi), Heifer Project International (HPI) MoALD.

Gaps:

- Validate cassava-based feed formulations in selected dairy Counties
- Economic analysis of cassava-based feed formulation
- Economics of milk production from Cassava-based Napier grass silage

2.2.12 Napier grass, gliricidia forage and maize bran silage

2.2.12 TIMP name	**Napier grass, gliricidia forage and maize bran silage**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Feed scarcity and low milk yield during the dry season

What is it? (TIMP description)	This is a basal diet conserved towards the end of the wet season for use during the dry season when forage production is low. It is includes a mixture of; wilted chopped Napier grass, wilted gliricidia forage and maize bran in the ratio of 70:25:5. Gliricidia forage can be substituted by other forage legumes with the mixture fermented under anaerobic conditions for at least six weeks. It can be ensiled in a pit or small airtight container/bag. The silage can be used as a total ration without additional supplementation because its protein content is above 16%. It should be fed after milking to avoid milk tainting  Napier grass, gliricidia forage and maize bran silage making Source: KALRO
Justification	Smallholder farmers in Kenya mainly depend on forages to feed livestock. Forage is plenty during the rainy season and scarce during the dry season affecting milk production. Preservation of surplus has the potential for increasing or stabilizing milk production. The Napier grass and gliricidia-based silage is an option for providing high quality feed during the dry season and the technology utilizes maize bran to replace molasses which is not readily available. This technology should be up-scaled in dairy producing areas to sustain milk production during the dry season.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy farmers, extension agents, researchers, service providers, agri-preneurs.
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals

Critical/essential factors for successful promotion	• Reliable markets and favourable milk prices • Suitable high yielding Napier grass, forage legumes and maize germ
Partners/stakeholders for scaling up and their roles	• KALRO - training ToTs and technical backstopping • Extension service providers (public and private) - training farmers on silage making • Farmer groups - provide land and manage demonstration sites
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Laikipia, Baringo, Elgeyo Marakwet, Machakos, Kakamega, Kericho, Lamu, Kajiado, Nyandarua, Taita Taveta, Tharaka Nithi, Uasin Gishu, West Pokot
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate skills in silage preparation • Low technology awareness levels
Recommendations for addressing the challenges	Capacity build the service providers who will train farmers on how to make Napier grass, gliricidia and maize bran silage
Lessons learned	• Gliricidia and maize bran can replace molasses in silage making • The farmers who used Napier grass, gliricidia and maize germ silage never experienced devastating effects of drought and they sustained milk production
Social, environmental, policy and market conditions necessary	• Willingness of farmers to adopt the technology • Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of napier and gliricidia planting materials distributed to farming community • Premium milk prices during the dry season to cover for cost of silage making • Reliable markets and stable milk prices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production for 1 kg silages ranges from KES 5 – 10 for silage made in a pit.
Estimated returns	The cost of production of silage/acre/year is KES 55,000 producing 5.5 Tons DM/year. A 45 kg goat consumes 1.5 kgs DM/day translating to a cost of KES 20/goat/day. A goat produces up to 3 litres of milk/day when fed silage alone assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is

	KES 120 which translates to a revenue of KES 360/day/goat giving gross margin returns of KES 340/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have less access to land for napier grass, gliricidia and maize cultivation. • The technology is labour intensive and may not be adopted by women who are already overburdened with other activities such as domestic, care and other productive activities • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services. • Women have less access to resources such as credit, implements and inputs for napier grass, gliricidia forage and maize bran silage making. • Men dominate decision on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit, knowledge and information. • Employment opportunities for youths exist in performing the task
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for napier grass, gliricidia forage and maize cultivation. • VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit, knowledge and information. • Employment opportunities for youths exist in performing the task
E: Case studies/profiles of success stories	
Success stories	The technology was validated in Kwale and Kilifi Counties and farmers have benefited from increased incomes from its use.

Application guidelines for users	An extension leaflet is available for reference in the KALRO website.
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 –Mtwapa PO BOX 16 – 80109. MTWAPA (K)
Lead organization and scientists	KALRO - Mwapa Munga G., Mambo, L., Ramadhan, A., and Muinga, R.
Partner organizations	KALRO and MoALD

Gap

Validate use of alternative legume forages such Vetch, Calliandra, Tree Lucerne among others.

2.2.13 Oat/Napier grass -Vetch legume intercrop

2.2.13 TIMP name	**Oat/Napier grass-Vetch legume intercrop**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity of livestock resulting from use of low quality feeds
What is it? (TIMP description)	Vetch legume is a protein rich climber and can intercropped with Napier/oat grass to improve the nutritive value of the fodder as well as improve output per unit, therefore increase milk production.
Justification	Feeding dairy goats on Napier/oat grasses alone is not enough to attain the production potential of dairy cows due to low nutritive value. This can be improved by use of a high protein feed supplement. The inclusion of vetch is a cheaper supplementation option for dairy farmers. Feeding dairy cows on Napier/oat grass-vetch intercrop as green chop increases milk production as compared to feeding with Napier grass alone. Additionally, Oat- vetch hay can be fed to animals or sold for household income.

	  Napier-Vetch intercrop Oat-Vetch intercrop Source: KALRO
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension officers, researchers and agri-preneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	Availability of clean planting material and technical brochures.
Partners/stakeholders for scaling up and their roles	• KALRO - avail the planting material, training and technical backstopping • National and County Ministry of Agriculture and Livestock Development – training of farmers and extension services • CBOs, NGOs - seed multiplication and technology dissemination • Farmers - test/validate and produce. • KEPHIS - seed production regulation
C: Current situation and future scaling up	
Counties where already promoted if any	Nyandarua
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• The technology is labour intense especially at establishment • Substantive resources are required to establish the technology

Suggestions for addressing the challenges	• Formation of farmer groups to help in sourcing resources to get planting materials especially seeds • Enhancement of promotion of the technology through various platform
Lessons learned in upscaling if any	Use of Oat/Napier grass-Vetch legume intercrop increases yields and quality of fodder.
Social, environmental, policy and market conditions necessary for development and upscaling	• Favourable climatic conditions • Availability of information on seed quality check policies as stipulated in the seed and plant variety and implemented by KEPHIS that provides assurance of cleanliness of planting materials distributed to farming community • Good milk markets to cater for anticipated yield increases
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs of the TIMP	• It will cost approximately KES 61,000 per acre to produce Oat-Vetch crop • Cost of production a bale of Oat-Vetch intercrop is about KES 280
Estimated returns when using the TIMP	The cost of production of Oats/Napier grass- Vetch/acre/year is KES 49,000 producing 45 Tons DM/year. A 45 kg goat consumes 1.5 kg DM/day which cost KES 1 per kg translating to a cost of KES 3/goat/day. A goat produces up to 2.5 litres of milk/day when fed Oats/Napier grass -Vetch intercrop assuming that the required climatic conditions are favourable and management practices are optimal. Price of milk/litre is KES120 which translates to a revenue of KES 300/day/goat giving gross margin returns of KES 297/goat/day.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for vetch - napier grass intercrop cultivation. • Women have limited access to education, training and extension services. • Women have limited access to resources such as credit, implements and inputs for Vetch-napier grass intercrop cultivation. • While women perform most activities on Oat/napier grass-vetch intercrop, they may not be involved in decision making on livestock production and marketing at the household level
Gender related opportunities	Affirmative action opportunities exist for women and youths to acquire the required credit, knowledge and information.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Oat/apier grass-vetch intercrop cultivation • VMGs have limited access to agricultural information, technology and knowledge

	• VMGs have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit, knowledge and information.
E: Case studies/profiles of success stories.	
Success stories from previous similar projects	None
Application guidelines for users	Leaflets available on KALRO website
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research).	Ready for up scaling
G: Contacts	
Contacts	The Institute Director, Dairy Research Institute, P.O. BOX 25-20117 Naivasha Tel: + 020 2390930, Email: director.dri@kalro.org
Lead organization and scientists.	KALRO Naivasha and Ol Joro Orok N. Kanegeni, G. Juma, W. Ayako, N. Mathai and E. Nyambati.
Partner organizations	KALRO, MoALD , KEPHIS.

Gap

Further research on vetch intercropped with other grasses.

2.3 Forage production

2.3.1 Buffel grass (*Cenchrus ciliaris*) var. MGD-1

2.3.1 TIMP Name	**Buffel grass (*Cenchrus ciliaris*) var. MGD-1**
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Low dairy goat productivity resulting from shortage of feed due to unavailability of commercial range grass varieties
What is it? (TIMP description)	Buffel grass var. MGD-1 is a rhizomatous range grass variety that is drought tolerant, persistence to grazing pressure and matures in 3 - 4 months. It is an ecotype of *Cenchrus ciliaris* from Magadi, Kenya. The crude protein (CP) at 50% flowering stage is up to 12% with dry matter

	of 2.5 tons/acre. It is suitable for direct grazing, cut and carry or baling. The variety is competitive and aggressive growth against weeds. It is early maturing and vigorous growth after harvest. It is good for rangeland rehabilitation and soil erosion control with over 20 years of productive life with proper management.  Buffel grass var. MGD-1 Source: KALRO
Justification	Indigenous range grass species have been used by livestock producers in the ASALs for a long time. However, performance of the grasses in terms of biomass yield, nutritive value, drought tolerance, persistence to grazing etc. has been unsatisfactory hence the declining productivity of the livestock. This makes it necessary to explore ways of improving performance of the grasses and some of the options include identification & promotion of superior ecotypes and breeding to develop completely new varieties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Researchers, extension personnel, farmer groups, CIGs, individual farmers and agri-preneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Public and private agricultural extension services
Critical/essential factors for successful promotion	Registration and certification of the variety by KEPHIS

Partners/stakeholders for scaling up and their roles	• KALRO – technical backstopping, technology development and refinement • KEPHIS - certification of the varieties • County Governments – promotion to farmers of the varieties, assist farmers access the seeds • Farmers/farmer groups – use the varieties to produce feed for their livestock or sale
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	None
Suggestions for addressing challenges	None
Lessons learned in up scaling if any	None
Social, environmental, policy and market conditions necessary for development and up scaling	Registration and certification of the variety by KEPHIS
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Pasture seeds 5,000 (5 kg @ 1,000) per acre Ploughing and harrowing 5000 per acre Planting 4,000 (8 Mandays @ 500) per acre Weeding 2,000 (4 Mandays @ 500) per acre Total = KES16,000 per acre Cost of feed per day per 45 kg goat KES 12.
Estimated returns	KES 68 (1 litre of milk @ 80-12) OR KES 19,000 per acre per season (KES 35,000 i.e. 2,500 kg sale of DM @ KES 14per kg less cost of 16,000).
Gender issues and concerns in development, dissemination,	• Women have limited access to land for Buffel grass var. MGD-1 cultivation • Women have limited access to education, training and extension services

adoption and scaling up	• Women have limited access to resources such as credit, implements and inputs for Buffel grass var. MGD-1 cultivation • While women perform most activities on Buffel grass var. MGD-1 production, they may not be involved in decision on livestock production and marketing at the household level
Gender related opportunities	Business opportunity exist for youth to rent land grow Buffel grass and sell to other farmers.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Buffel grass var. MGD-1 cultivation • VMGs have limited access to agricultural information, technology and knowledge • VMGs have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Employment opportunity exist for women and youths in grass seed harvesting.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	• KALRO: Range grasses factsheet *Cenchrus ciliaris* (African foxtail grass) https://kalro.org/sites/default/files/African-foxtail-grass.pdf • Mnene, W. N, E. C. Kirwa, B. K. Kidake, B. P. Ogillo, D. Kubasu and R. Kimitei: Community based range grass seed bulking and management manual https://www.kalro.org/asal-aprp/sites/default/files/Good_quality_range_grass_seed_manual_final-1.pdf Authors: • Heuzé V., Tran G., Baumont R., Lebas F., 2016. Buffel grass (*Cenchrus ciliaris*). Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. https://www.feedipedia.org/node/482
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org

Lead organization and scientists	KALRO ARLRI Kiboko Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu KALRO GeRRI Muguga Dr. Everlyne Kirwa
Partner organizations	KEPHIS, County governments, farmers and farmer groups

Gap

Finalize seed certification and formal release by KEPHIS.

2.3.2 Buffel grass (*Cenchrus ciliaris*) var. TVT-3

2.3.2 TIMP Name	**Buffel grass (*Cenchrus ciliaris*) var. TVT-3**
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Low productivity due to feed shortage resulting from unavailability of commercial range grass varieties
What is it? (TIMP description)	Buffel grass (*Cenchrus ciliaris*) var. TVT-3 is a rhizomatous range grass variety that is drought, persistence to grazing pressure and matures in 3-4 months. It is an ecotype of *Cenchrus ciliaris* from Taveta, Kenya. The leaves have a characteristic bluish-green in colour. It is suitable for direct grazing, cut and carry or baling. At 50% flowering, it has crude protein (CP) up to 11% and dry matter of 3 tons/acre. The pasture spreads easily through rhizomes and aggressively grows against weeds. It is good for soil erosion control with over 20 years of productive life with proper management.  Buffel grass var. TVT-3 Source: KALRO
Justification	Indigenous range grass species have been used by livestock producers in the ASALs for a long time. However, performance of the grasses in terms of biomass yield, nutritive value, drought tolerance, persistence to grazing etc. is unsatisfactory hence the declining productivity of the livestock. This makes it necessary to explore ways of improving

	performance of the grasses including identification &promotion of superior ecotypes and breeding to develop completely new varieties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Researchers, extension personnel, farmer groups, CIGs, individual farmers and agri-preneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	Registration and certification of the variety by KEPHIS
Partners/stakeholders for scaling up and their roles	• KALRO – technical backstopping, technology development and refinement • KEPHIS - certification of the varieties • County governments – promotion to farmers of the varieties, assist farmers access the seeds • Farmers/farmer groups – use the varieties to produce feed for their livestock or sale
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	-
Suggestions for addressing challenges	-
Lessons learned in up scaling if any	-
Social, environmental, policy and market conditions necessary	Registration and certification of the variety by KEPHIS.

for development and up scaling	
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Pasture seeds 5,000 (5 kg @ 1,000) per acre Ploughing and harrowing 5000 per acre Planting 4,000 (8 Mandays @ 500) per acre Weeding 2,000 (4 Mandays @ 500) per acre Total KES16,000 per acre Cost of feed per day per 45 kg goat KES 10.
Estimated returns	KES 70 (1 litre of milk @ 80-10) or KES 19,000 per acre per season (KES 35,000 i.e. 2,500 kg sale of DM @ KES 14 per kg less cost of KES 16,000).
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for Buffel grass var. TVT-3 cultivation • Women have limited access to resources such as credit, implements and inputs for Buffel grass var. TVT-3 cultivation • While women perform most activities on Buffel grass var. TVT-3 production they may not be involved in making decision on livestock production and marketing at the household level
Gender related opportunities	Business opportunity exist for youth to rent land grow Buffel grass and sell to other farmers.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Buffel grass var. TVT-3 cultivation. • VMGs have limited access to agricultural information, technology and knowledge. • VMGs have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Employment opportunity exist for women and youths in grass seed harvesting.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Still under validation
Application guidelines for users	• KALRO: Range grasses factsheet *Cenchrus ciliaris* (African foxtail grass) https://kalro.org/sites/default/files/African-foxtail-grass.pdf • Mnene, W. N, E. C. Kirwa, B. K. Kidake, B. P. Ogillo, D. Kubasu and R. Kimitei: Community based range grass seed bulking and management manual https://www.kalro.org/asal-

	aprp/sites/default/files/Good_quality_range_grass_seed_manual_final-1.pdf Authors • Heuzé V., Tran G., Baumont R., Lebas F., 2016. Buffel grass (*Cenchrus ciliaris*). Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. https://www.feedipedia.org/node/482
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Still under validation
G: Contacts	
Contacts	Institute Director ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org
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Partner organizations	KEPHIS and County Governments

Gap

Finalize seed certification process and formal release by KEPHIS.

2.3.3 Bushrye grass (*Enteropogon macrostachyus*) var. ENMA-KBK

2.3.3 TIMP Name	**Bushrye grass (*Enteropogon macrostachyus*) var. ENMA-KBK**
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Low productivity due to feed shortage resulting from unavailability of commercial range grass varieties
What is it? (TIMP description)	This is a tufted perineal range grass that is drought tolerant, persists grazing pressure and matures in 3-4 months. It is an ecotype of *Enteropogon macrostachyus* commonly found in Kiboko in Makueni County, Kenya. The grass is suitable for direct grazing, cut and carry or baling. It is palatable with crude protein (CP) up to 14% at 50% flowering and dry mater of 1.5 tons/acre. It easily establishes from seed. It is also shade tolerant (Can be intercropped with fruit and timber trees such as *Melia Volkensii*) making it ideal for silvo-pastoral system. It has over 10 years of productive life with proper management

	 Bushrye grass var. ENMA-KBK Source: KALRO
Justification	Indigenous range grass species have been used by livestock producers in the ASALs for a long time. However, performance of the grasses in terms of biomass yield, nutritive value, drought tolerance, persistence to grazing etc. is unsatisfactory hence the declining productivity of the livestock. This makes it necessary to explore ways of improving performance of the grasses including identification &promotion of superior ecotypes and breeding to develop completely new varieties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Researchers, extension personnel, farmer groups, CIGs, individual farmers, agri-preneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	Registration and certification of the variety by KEPHIS
Partners/stakeholders for scaling up and their roles	• KALRO – technical backstopping, technology development and refinement • KEPHIS - certification of the varieties • County Governments – provide extension services and assist farmers access the seeds • Farmer groups – use the varieties to produce feed for their livestock or sale

C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	-
Suggestions for addressing challenges	-
Lessons learned in up scaling if any	-
Social, environmental, policy and market conditions necessary for development and up scaling	Registration and certification of the variety with KEPHIS.
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Pasture seeds 5,000 (5 kg @ 1,000) per acre Ploughing and harrowing 5000 per acre Planting 4,000 (8 Mandays @ 500) per acre Weeding 2,000 (4 Mandays @ 500) per acre Total KES16,000 per acre Cost of feed per day per 45 kg goat KES 15.
Estimated returns	KES 65 (1 litre of milk @ 80-15) or KES 19,000 per acre per season (All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.ES 35,000 i.e. 2,500 kg sale of DM @ KES 14 per kg less cost of KES16,000).
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for Bushrye grass var. ENMA-KBK cultivation • Women have limited access to resources such as credit, implements and inputs for Bushrye grass var. ENMA-KBK cultivation

	• While women perform most activities on Bushrye grass var. ENMA-KBK production, they may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	Business opportunity exist for youth to rent land and plant Bushrye grass var. ENMA-KBK for sell to other farmers.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Bushrye grass var. ENMA-KBK cultivation • VMGs have limited access to agricultural information, technology and knowledge • VMGs may also have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Employment opportunity exist for women and youths in grass seed harvesting.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	• KALRO: Range grasses factsheet *Enteropogon macrostachyus* (Bush Rye) https://www.kalro.org/arlri/sites/default/files/Bush-Rye.pdf • Mnene, W. N, E. C. Kirwa, B. K. Kidake, B. P. Ogillo, D. Kubasu and R. Kimitei: Community based range grass seed bulking and management manual https://www.kalro.org/asal-aprp/sites/default/files/Good_quality_range_grass_seed_manual_final-1.pdf Authors • Ogillo B.P., Kirwa E.C., Kidake B.K., and Mnene W.N: How to Harvest Range Grass Seeds. https://www.kalro.org/asal-aprp/sites/default/files/Brochure_on_range_grass_seed_harvesting__FINAL.pdf
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	-
G: Contacts	
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Lead organization and scientists	KALRO-ARLRI Kiboko Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu KALRO - GeRRI Muguga Dr. Everlyne Kirwa
Partner organizations	KEPHIS, County Governments

Gaps

1. Finalize seed certification process and formal release by KEPHIS
2. Development of new varieties

2.3.4 Horsetail grass (*Chloris roxburghiana*) var. CHROX-KBK

2.3.4 TIMP Name	**Horsetail grass (*Chloris roxburghiana*) var. CHROX-KBK**
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Low productivity due to shortage of livestock feed resulting from unavailability of commercial range grass varieties
What is it? (TIMP description)	This is a tufted perineal range grass that is drought tolerant, persistent to grazing pressure and matures in 3-4 months. It is an ecotype of *Chloris roxburghiana* commonly found in Kiboko area in Makueni County, Kenya. It is suitable for direct grazing, cut and carry or baling. It has crude protein (CP) up to 16% at 50% flowering stage. It is fairly shade tolerant (can be intercropped with fruit and timber trees such as *Melia volkensii*) and can remain productive for up to 10 years with proper management.  Horsetail grass var. CHROX-KBK Source: KALRO
Justification	Indigenous range grass species have been used by livestock producers in the ASALs for a long time. However, performance of the grasses in terms of biomass yield, nutritive value, drought tolerance, persistence to grazing

	etc. is unsatisfactory hence the declining productivity of the livestock. This makes it necessary to explore ways of improving performance of the grasses including identification &promotion of superior ecotypes and breeding to develop completely new varieties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Researchers, extension personnel, farmer groups, CIGs, individual farmers and agri-preneurs.
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	Registration and certification of the variety by KEPHIS.
Partners/stakeholders for scaling up and their roles	• KALRO – technical backstopping, technology development and refinement • KEPHIS - certification of the varieties • County Governments – provide extension services and assist farmers access the seeds • Farmers– use the varieties to produce feed for their livestock or sale
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	-
Suggestions for addressing challenges	-
Lessons learned in up scaling if any	-
Social, environmental,	Registration and certification of the variety by KEPHIS

policy and market conditions necessary for development and up scaling	
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Pasture seeds 5,000 (5 kg @ 1,000) per acre Ploughing and harrowing 5000 per acre Planting 4,000 (8 Mandays @ 500) per acre Weeding 2,000 (4 Mandays @ 500) per acre Total KES16,000 per acre Cost of feed per day per 45 kg goat KES 15.
Estimated returns	KES 65 (1 litre of milk @ 80-15) or KES 19,000 per acre per season (KES 35,000 i.e. 2,500kg sale of DM @ KES 14 per kg less cost of KES 16,000).
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for Horsetail grass var. CHROX-KBK cultivation • Women have limited access to education, training and extension services • Women have less access to resources such as credit, implements and inputs for Horsetail grass var. CHROX-KBK cultivation
Gender related opportunities	Business opportunity exist for youth to rent land to grow and sell grass seeds to other farmers
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Horsetail grass var. CHROX-KBK cultivation. • VMGs have limited access to agricultural information, technology and knowledge. • VMGs have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Employment opportunity exist for women and youths in grass seed harvesting
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	• KALRO: Range grasses factsheet *Chloris roxburghiana* (Horsetail grass) https://www.kalro.org/arlri/sites/default/files/Horsetail-grass.pdf

	• Mnene, W. N, E. C. Kirwa, B. K. Kidake, B. P. Ogillo, D. Kubasu and R. Kimitei: Community based range grass seed bulking and management manual found https://www.kalro.org/asal-aprp/sites/default/files/Good_quality_range_grass_seed_manual_final-1.pdf • Ogillo B.P., Kirwa E.C., Kidake B.K., and Mnene W.N: How to Harvest Range Grass Seeds. https://www.kalro.org/asal-aprp/sites/default/files/Brochure_on_range_grass_seed_harvesting__FINAL.pdf
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Still under validation
G: Contacts	
Contacts	Institute Director ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org
Lead organization and scientists	KALRO - ARLRI Kiboko Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu KALRO - GeRRI Muguga Dr. Everlyne Kirwa
Partner organizations	KEPHIS, County governments, farmers and farmer groups

Gaps

1. Finalize seed certification process and formal release by KEPHIS
2. Development of new varieties

3.3.5 Maasai Love Grass (*Eragrostis superba*) var. ERSU-1

TIMP Name	**Maasai Love Grass (*Eragrostis superba*) var. ERSU-1**
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Low livestock productivity due to shortage feed resulting from unavailability of commercial range grass varieties
What is it? (TIMP description)	A perennial range grass species, densely tufted and is a good seeder ecotypes selected from indigenous *Eragrostis superba*. The grass is drought tolerant, persistent to grazing pressure and matures in 3-4 months. Dry matter production is 2.2t/acre and crude protein (CP) of 9-11% at 50%

	flowering stage. The grass has a productive lifespan of over 15 years with proper management.  Maasai Lovegrass var. ERSU-1 Source: KALRO
Justification	Indigenous range grass species have been used by livestock producers in the ASALs for a long time. However, performance of the grasses in terms of biomass yield, nutritive value, drought tolerance, persistence to grazing etc. is unsatisfactory hence the declining productivity of the livestock. This makes it necessary to explore ways of improving performance of the grasses including identification &promotion of superior ecotypes and breeding to develop completely new varieties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Researchers, extension personnel, farmers, farmer groups and agri-preneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	Registration and certification of the variety by KEPHIS
Partners/stakeholders for scaling up and their roles	• KALRO – technical backstopping, technology development and refinement • KEPHIS - certification of the varieties • County governments – provide extension services and assist farmers access the seeds • Farmers– use the varieties to produce feed for their livestock or sale
C: Current situation and future scaling up	

Counties where already promoted if any	-
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	-
Suggestions for addressing challenges	-
Lessons learned in up scaling if any	-
Social, environmental, policy and market conditions necessary for development and up scaling	Registration and certification of the variety by KEPHIS
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Pasture seeds 5,000 (5 kg @ 1,000) per acre Ploughing and harrowing 5000 per acre Planting 4,000 (8 Mandays @ 500) per acre Weeding 2,000 (4 Mandays @ 500) per acre Total KES16,000 per acre Cost of feed per day per 45 kg goat KES 13.
Estimated returns	KES 67 (1 litre of milk @ 80-13) or KES 19,000 per acre per season (35,000/= i.e. 2,500kg sale of DM @ KES 14 per kg less cost of KES 16,000).
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land to implement the technology • Women have limited access to education, training and extension services • Women have limited access to resources such as credit, implements and inputs
Gender related opportunities	Business opportunity exist for youth to rent land to grow and sell grass seeds to other farmers.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to implement the technology. • VMGs have limited access to agricultural information, technology and knowledge • VMGs have limited access to finances to buy the required inputs such as quality planting materials, manure and fertilizers

	• VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Employment opportunity exist for women and youths in grass seed harvesting.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	• KALRO: Range grasses factsheet *Eragrostis superba* (Maasai love grass) https://www.kalro.org/arlri/sites/default/files/Maasai-love-grass.pdf • Mnene, W. N, E. C. Kirwa, B. K. Kidake, B. P. Ogillo, D. Kubasu and R. Kimitei: Community based range grass seed bulking and management manual found https://www.kalro.org/asal-aprp/sites/default/files/Good_quality_range_grass_seed_manual_final-1.pdf • Ogillo B.P., Kirwa E.C., Kidake B.K., and Mnene W.N: How to Harvest Range Grass Seeds. https://www.kalro.org/asal-aprp/sites/default/files/Brochure_on_range_grass_seed_harvesting__FINAL.pdf
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	-
G: Contacts	
Contacts	Institute Director ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org
Lead organization and scientists	KALRO - GeRRI Muguga Dr. Everlyne Kirwa KALRO - ARLRI Kiboko Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu
Partner organizations	KEPHIS, County governments

Gaps

1. National Performance Trials and distinctiveness uniformity and stability of the grass varieties needed to facilitate registration and formal release by KEPHIS
2. Need to develop improved varieties by crossing the ecotypes Kiboko 1(KBK1), Kiboko 2 (KBK2) & Kilifi 1 (KLF1) ecotypes to facilitate adoption of the ERSU ecotypes
3. There is need to conduct feeding trials for all the range grass varieties being promoted to check on animal performance. This has not been done even on the indigenous grasses that are already being promoted for establishment of new pasture fields and rehabilitation of degraded rangelands. Results of the trials would provide evidence for farmers to adopt the grass varieties
4. Develop more comprehensive dairy goat feed rations based on locally available material
5. There are a number of naturally occurring legumes in ASALs which need to be explored with a view of domesticating, bulking the planting material and disseminating the same to producers for use as protein sources in finishing beef, mutton and chevon
6. Cost/benefit analysis of community-based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP

2.3.6 Community-based range grass seed bulking

2.3.6 TIMP Name	**Community-based range grass seed bulking**
Category	Management Practice
A: Description of technology, innovation or Management practice	
Problem to be addressed	Low livestock productivity due shortage of feed resuting from unavailability of range grass seeds in the formal market system.
What is it? (TIMP description)	This comprises a set of management practices for bulking range grass seed at on farm level. It entails guidelines on harvesting, processing and storage of range grass seeds at on farm level.  

	Harvesting of grass seedS Drying of grass seeds Source: KALRO
Justification	Shortage of livestock feed is a major challenge affecting productivity of animals many smallholder dairy farms. Community-based range grass seed management and bulking is essential it guarantees availability of good quantity and quality seed for feed production. In addition, the seed can be used for reseeding and restoration of degraded rangelands making them more productive and resilient to continue supporting livestock. Besides using the seeds to reseed the degraded lands, the seeds are also shared or sold among members thus, can be source of household income.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	County governments, Common Interest Groups (CIGs), ndividual farmers, researchers and agri-preneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Regular extension visits to capacity build smallholder farmers • Business orientation of the farmers • Availability of seeds for multiplication and bulking • Land to establish the seed bulking fields • Availability of seed germination testing services • Availability of viable markets for the seeds
Partners/stakeholders for scaling up and their roles	• KALRO – backstopping, technology development and refinement • KEPHIS – seed certification • County governments – mobilization and training of farmers • Common Interest Groups (CIGs) – produce and market the seeds, train farmers, Individual farmers – produce and market seeds
C: Current situation and future scaling up	
Counties where already promoted	Makueni, Taita Taveta, Kajiado, Narok, Tana River

Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate support of extension staff by county governments to carry out the dissemination work • Poor group dynamics • unavailability of starter seeds
Recommendations for addressing challenges	• County governments to provide more support to extension staff • Training CIGs on group dynamics • Encourage farmers to harvest seed from within the farm
Lessons learned in up scaling if any	Building capacity of farmers to engage in commercial seed bulking not only helps in rehabilitating degraded rangelands but also positively transforms the lives of farmers through revenue generation.
Social, environmental, policy and market conditions necessary for development and up scaling	• Strong group dynamics is important for success of the group activities • Registration and formal release of grass varieties by KEPHIS is crucial to facilitate formal marketing of the seeds • Registering of producer groups as seed merchants with KEPHIS to facilitate marketing is necessary
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Pasture seeds 5,000 (5 kg @ 1,000) per acre Ploughing and harrowing 5000 per acre Planting 4,000 (8 Mandays @ 500) per acre Weeding 2,000 (4 Mandays @ 500) per acre Total KES16,000 KES per acre
Estimated returns	KES 50,000 (50kg of seed @ 1,000) per acre or KES 28,000 (2,000 kg sale of DM @ KES 14 per kg) per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth have limited access to land for the management practice. • Women and youth have limited access to resources such as credit, implements and inputs for implementing the management practice • While women perform most activities to implement the management practice they may not be involved in making decisions on livestock production and marketing at the household and community level

Gender related opportunities	Employment opportunity exist for women and youths in performing the various activities of the management practice e.g. harvesting of grass seeds
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to land for Management practice • VMGs have limited access to information and knowledge on the management practice. • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Employment opportunity exist for women and youths in performing the various activities in implementing the management practice such as grass seed harvesting
E: Case studies/profiles of success stories	
Success stories from previous similar projects	The success registered by Kavatini Pastoralists Livestock Improvement Group (KAPALIG) is worth telling. Some members have completely transformed their lives using proceeds from seed sales. The members have also succeeded in training other farmers and are invited to go and train other farmers outside Makueni County.
Application guidelines for users	• W. N, E. C. Kirwa, B. K. Kidake, B. P. Ogillo, D. Kubasu and R. Kimitei. Community based range grass seed bulking and management manual on KALRO website https://www.kalro.org/asal-aprp/sites/default/files/Good_quality_range_grass_seed_manual_final-1.pdf • Ogillo B.P., Kirwa E.C., Kidake B.K., and Mnene W.N How to Harvest Range Grass Seeds on KALRO website https://www.kalro.org/asal-aprp/sites/default/files/Brochure_on_range_grass_seed_harvesting__FINAL.pdf
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling.
G: Contacts	
Contacts	Institute Director ARLRI Kiboko P.O. Box 12 - Makindu, Kenya directorarlri@kalro.org
Lead organization and scientists	KALRO -ARLRI Kiboko

	Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu KALRO- GeRRI Muguga Dr. Everlyne Kirwa
Partner organizations	County governments, Farmer groups, MoALD

Gap

Cost/benefit analysis of community-based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP.

2.4 Feeds Formulation

2.4.1 Group bottle feeding of milk to kids

2.4.1 TIMP name	Group bottle feeding of milk to kids
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	High labour cost of weighing milk and feeding to individual kids repeatedly
What is it? (TIMP description)	Dairy goat kid group bottle feeding is a method of raising dairy goat kids (young goats) that involves feeding many kids using bottles rather than individually nursing them directly by their mothers. This approach involves giving milk or milk replacer to the kids in bottles, and it is commonly employed to guarantee that each kid receives appropriate nutrition, especially in larger herds or commercial operations.  Kids group feeding Source: KALRO

Justification	Labour is one of the constraints under the zero grazing system recommended for dairy goats. Survival of goat kid is necessary for replacement stock and the overall dairy goat industry. Bottle feeding allows kids to consume milk at their own pace for the quantity provided which eases labour costs.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agents, researchers , agri-preneurs
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Capacity building of service providers and dairy goat farmers to adopt the technology • Use of appropriate promotion methods • Involvement of all stakeholder in the promotion process
Partners/stakeholders for scaling up and their roles	• KALRO - capacity building and backstopping on feeder bottle materials and nipples • County Governments - identifying and organizing the farmer groups • Local NGOs in livestock VCs - community mobilization and training, dairy goat breeders and established multipliers
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMPs will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Cost of recommended feeding bottles (metallic) • unavailability of durable nipples
Suggestions for addressing the challenges	Identification of suppliers of affordable milk bottles and emphasizing on durability of nipples.
Lessons learned	There was improved health and growth rate of kids using bottle feeding.
Social, environmental, policy and market conditions necessary	• Willingness of farmers to adopt the technology • Availability of appropriate (metallic) feeding bootle and nipples

	• Favourable policies to support dairy goat farming • Attractive market for dairy goats and dairy products
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	-
Estimated returns	-
Gender issues and concerns in development, dissemination adoption and scaling up	• Women have limited access to land for goat production • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services. • Women have limited access to finances to buy the required inputs • While women perform most activities in dairy goat keeping they may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit for the inputs • Employment opportunities for youths exist in performing the task
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have low access to agricultural information, technology and knowledge • VMGs may also have limited access to finances to buy the required inputs such as metallic bottle feeders and nipples • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire credit for the required inputs • Employment opportunities for youths exist in performing the task of bottle feeding
E: Case studies/profiles of success stories	
Success stories	None
Application guidelines for users	A training manual (R. W. Weinaina, J.N. Kiura, C.B. Wasike, S.I. Mwangi, D. Ondoro, W. Gachina, C. Wahome, L. Mukhebi, E.M. Nyambati and E. Ilatsia, 2022. Dairy goat management resource book, KALRO-DRI-Naivasha)
F: Status of TIMP Readiness (1. Ready for upscaling; 2.	Ready for upscaling

Requires validation; 3. Requires further research)	
G: Contacts	
Contacts	Institute Director KALRO Dairy Research Institute, Box 25 (20117) Naivasha, karinaivasha@gmail.com
Lead organization and scientists	KALRO (Dr R. W. Weinaina, Mr J.N. Kiura, Dr. E. Ilatsia
Partner organizations	County Governments, Dairy Goat Farmer Group Associations (DGAK, TNGB, MGBA), MoALD (Sheep and goat stations)

Gaps

1. Deterrmine growth and survival rates of bottle-fed kids in different agro-ecological zones
2. Economic analysis of bottle feeding of dairy goat kids

2.4.2 Use of sweet potato vines as a milk replacer for kids

2.4,2 TIMP name	**Sweet potato vines milk replacer for kids**
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Low kid survival rates due to high demand of goat milk necessitating an alternative feed for kids.
What is it? (TIMP description)	Sweet potato vines are the stems and leaves of the sweet potato plant (*Ipomoea batatas*). Among the sweet potato varieties developed and grown for livestock are Maroko, Wagabolige, Ex. Mukurweini. Fodder cultivars frequently exhibit robust growth patterns, spreading quickly and covering wide areas, making them effective biomass producers. Sweet potato fodder can be the main source of protein that goats need for healthy and rapid growth because the vine contains between 15 and 30% protein.   Sweet potato vines Healthy kids Source: KALRO
Justification	There is an increasing demand for goat milk which affects the survival of goat kids as most of the milk is offered for sale. Sweet

	potato vine is rich in crude protein (CP) protein and can be used as milk replacer as a cheaper option. The use of the innovation will ensure a supply of goat milk for household consumption and improvement of family income.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Public and private extension service, farmers, farmer groups, researchers, county governments, agri-preneurs
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	Capacity building of service providers and farmers, activity timing by day/season calendar
Partners/stakeholders for scaling up and their roles	• County Governments (County Livestock staff – identifying and organizing the farmer groups), local NGO in livestock VCs (community mobilization and training) • KALRO – capacity building and backstopping on critical period of use of the vines as a milk replacer
C: Current situation and future scaling up	
Counties where already promoted if any	Vihiga and Siaya counties
Counties where TIMPs will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	Possibility of kid mortality if feeding of colostrum and potato vines is not well managed,
Suggestions for addressing the challenges	Lobby county Governments to support farmers with availability of high forage yielding sweet potato varieties
Lessons learned	There was improved incomes from saved milk where sweet potato vines substituted milk in kid feeding
Social, environmental, policy and market conditions necessary	• Acceptability of sweet potato as dairy goat feed • Favourable climatic conditions for growing sweet potato • Market demand for goat milk
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	-

Estimated returns	-
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to land for SPV cultivation • Women have limited access to SPV information and knowledge • Women have limited access to education, training and extension services • Women have less access to credit to purchase quality planting material • While women perform most activities on SPV cultivation, they may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	Affirmative action opportunities exist for women and youths to acquire the credit for the required planting material
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for SPV cultivation • VMGs have limited access to agricultural information, technology and knowledge • VMGs may also have limited access to finances to buy the required inputs • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit
E: Case studies/profiles of success stories	
Success stories	None
Application guidelines for users	A manual (Semenye, P. P., H. A. Fitzhugh and W. R. Getz. (1992). Nutrition and management (Chapter 7, pp 71-98). In: Semenye, P. P. and Hutchraft, T. (Eds.). (1992). *On farm Research and Technology for Dual Purpose Goats***.** Small Ruminant Collaborative Research Support Program, Kenya. National Pring Press ltd., Kisumu, Kenya, 1992.
F: Status of TIMP Readiness	Technology for validation
G: Contacts	
Contacts	KALRO Dairy Research Institute, Box 25 (20117) Naivasha, karinaivasha@gmail.com; Pwani University, Box 195 (80100) Kilifi, pattersonsemenye@gmail.com
Lead organization and scientists	KALRO (Mr J.N. Kiura, Dr. E. Ilatsia, Dr R. W. Weinaina); Pwani University (Prof P.P Semenye)

Partner organizations	County Governments, Dairy Goat Farmer Group Associations (DGAK, MGBA)

Gaps

1. Validate sweet potato cultivars with high forage yields in different agro-ecological zones.
2. Conducting costs and returns of technology.

2.4.3 Doelings feeding

2.4.3 TIMP name	**Feeds for doelings**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Poor fertility in doelings due to feeding inadequate amounts of good quality feeds
What is it? (TIMP description)	It is a planned feed management program, which involves provision of quality grasses, legumes, and tree leaves to doelings of under one year of age with the aim of boosting their weight at first service (at least 25 kg) for better ovulation, conception and general health before mating. The doelings are provided with adequate high protein fresh feeds (6-8 kg) 2-3 times a day especially during the last two months before mating.  A well-fed doeling Source: KALRO
Justification	Goats under one year of age are important as they form the replacement stock. Feeding these goats with inadequate quality of feeds and only once in a day leads under-nutrition and reduced conception and general health before mating. Further, doelings

	not supplemented before service may not show heat signs. Plenty of fresh feed and supplementing before mating period ensures prompt heat signs with possibility of multiple ovulations for twins/triplets.
Region promoted	Kisumu, Kakamega, Kericho, Garissa, Tharaka Nithi, Kitui and Taita Taveta counties (TOTs)
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Extension agents and farmers
Approaches used in dissemination	• Training of CIGs, Farmers, ToTs, FFBS, On-farm demonstrations • Exhibition, Agricultural shows, regular localized meetings, demonstration plots • Use of digital platforms • Print media promotional materials (posters, brochures, leaflets, pamphlets and manuals) • Mass media and Web material's, Mobile Apps and SMS, Digital platforms • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Public and private agricultural extension services
Critical/essential factors for successful promotion	• Capacity building of service providers and farmers • Availability of essential feeds in adequate amounts and quality
Partners/stakeholders for scaling up	• County Government Agricultural staff (identifying and organizing the farmer groups) • Local NGO in livestock VCs (community mobilization and training), farmer association group members • KALRO (capacity building and backstopping on feeding the doelings)
C: Current situation and future scaling up	
Counties where TIMPs will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Grazing/intermingling doelings together with bucks or bucklings • Lack of holding pens for male and female goats
Recommendations for addressing the challenges	• Separate male and female goats while they feed or when housed
Lessons learned	• Many farmers rear does and bucks separately but may be late to separate these and bucklings can be sexually active at 4 months of age

	• Healthy does that are well fed pass these benefits to their kid(s)
Social, environmental, policy and market conditions necessary	• Dairy goats are accepted due to lower feed requirements as land holdings are becoming smaller, and goat milk could enhance food availability at household level • Goats waste is limited and thus release less methane gas than cattle hence contribute less to GHGs • Goat milk is a legally accepted product for sale in Kenya • The market demands more goat milk and will take up all available milk
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	A pregnant doe costs KES 18,000-25,000 that increases household income.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women perform the tasks of feeding, milking and selling milk therefore the technology may not be adopted if the technology increases their amount of work; the activity is set to fit within the existing feeding system • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services. • Men dominate decisions on livestock production at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire credit for the required supplement feeds, such as table banking and micro-finance institutions • Employment opportunities for youth exist in performing the task of feeding
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs may also have limited access to finances to buy the required inputs • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire credit for the required feed supplements • Employment opportunities for VMGs exist in performing the task of feeding

E: Case studies/profiles of success stories	
Success stories	Market links for sale of breeding stock in some areas (DGAK)
Application guidelines for users	A manual (Semenye, P. P., H. A. Fitzhugh and W. R. Getz. (1992). Nutrition and management. In: Semenye, P. P. and Hutchraft, T. (Eds.). (1992). *Onfarm Research and Technology for Dual Purpose Goats***.** Small Ruminant Collaborative Research Support Program, Kenya. National Pring Press ltd., Kisumu, Kenya, 1992. ISBN 9966-879-06-4)
Status of TIMP	Information ready for upscaling.
F: Contacts	
Contacts	KALRO Dairy Research Institute, Box 25 (20117) Naivasha, karinaivasha@gmail.com; Pwani University, Box 195 (80100) Kilifi, pattersonsemenye@gmail.com
Lead organization and scientists	KALRO DAIRY RESEARCH INSTITUTE – NAIVASHA, Mr J.N. Kiura, Dr. E. Ilatsia, Dr R. W. Weinaina
Partner organizations	County Governments, Dairy Goat Farmer Group Associations (DGAK, MGBA, KMGBA, NDGFA)

Gap

Validating results in new sites

2.4.4 Feeding the lactating doe

2.4.4 TIMP name	**Feeding the lactating doe**
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low milk production by lactating does due to inadequate feeds of good quality
What is it? (TIMP description)	It is the provision of adequate fresh forage feeds (8-10 kg), high energy, and protein concentrate (150-200 g) during the last two months before kidding and in lactation period (8-10 kg forage) and energy and protein concentrate (300 g) at least twice a day for improved milk production. The good diet boosts the foetal growth, mammary gland development, and maintains it in good health during the kidding and lactation period, a factor that ensures birth of healthy kids.

	 A well-fed lactating dairy goat Source: KALRO
Justification	Milk is the ultimate product from dairy goats. A goat requires plenty of nutritious forage as basal diet and supplementary feeds when lactating. Some farmers feed a mixture of feeds only once in a day which does not provide adequate dry matter intake. A goat that is not supplemented with energy and protein may not give milk beyond that is required by its kid(s). Adequate basal and supplementary feeds, minerals and water are needed during lactation. Providing feeds with high protein (12% CP) and less fibrous feeds is required during lactation to sustain sufficient milk production.
Region promoted	Kisumu, Kakamega, Kericho, Garissa, Tharaka Nithi, Kitui and Taita Taveta (TOTs)
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Extension agents and farmers
Approaches used in dissemination	• Training of CIGs, Farmers, ToTs, FFBS, On-farm demonstrations • Exhibition, Agricultural shows, regular localized meetings, demonstration plots • Use of digital platforms • Print media promotional materials (posters, brochures, leaflets, pamphlets and manuals) • Mass media and Web material's, Mobile Apps and SMS, Digital platforms • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Public and private agricultural extension services
Critical/essential factors for successful promotion	• Capacity building of service providers and farmers

Partners/stakeholders for scaling up	• County Government Agricultural staff (identifying and organizing the farmer groups) • Local NGO in livestock VCs (community mobilization and training), farmer association (group members) • KALRO (capacity building and backstopping on feeding of various feeds)
C: Current situation and future scaling up	
Counties where TIMPs will be upscaled	Meru, Embu, Homa Bay, Nyeri, Kirinyaga, and Migori counties.
Challenges in dissemination	• Inadequate or expensive basal and supplementary feeds • Low quality of goat feeds
Recommendations for addressing the challenges	Planting own fodder and feeding the correct proportions of forage and concentrates
Lessons learned	• Many farmers provide feeds in terms of quantity but may not be familiar with types of nutrients required by the lactating goats
Social, environmental, policy and market conditions necessary	• Dairy goats are easily accepted due to lower feed requirements as land holdings are becoming smaller • Milk from goats will enhance food availability at household level • Goats release less methane gas than cattle hence contribute less GHGs • Goat milk is a legally accepted product for sale in Kenya • Goat milk and its products have a niche market due aroma and health benefits to humans though this knowledge is not widely upscaled
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	A litre of goat milk retails at KES 60-200 and can boost household income.
Gender issues and concerns in development, dissemination, adoption and scaling up	• The technology may increase women's work burden as they perform most tasks in milking and selling of milk, however it will fit within the existing feeding system • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services. • Men dominate decisions on livestock production at the household level
Gender related opportunities	• Employment opportunities for male youth exist in performing the task of providing feeds

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have low access to agricultural information, technology and knowledge • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Employment opportunities for VMGs exist in performing the task of providing goat feeds
E: Case studies/profiles of success stories	
Success stories	Market links for sale of breeding stock in some areas
Application guidelines for users	A training manual (R. W. Weinaina, J.N. Kiura, C.B. Wasike, S.I. Mwangi, D. Ondoro, W. Gachina, C. Wahome, L. Mukhebi, E.M. Nyambati and E. Ilatsia, 2022. Dairy goat management resource book, KALRO-DRI-Naivasha)
Status of TIMP	Technology ready for upscaling.
F: Contacts	
Contacts	R. W. Weinaina, J.N. Kiura, E. Ilatsia, DRI-Naivasha
Lead organization and scientists	KALRO DAIRY RESEARCH INSTITUTE – NAIVASHA, Mr J.N. Kiura, Dr. E. Ilatsia, Dr R. W. Weinaina
Partner organizations	County Governments, Dairy Goat Farmer Group Associations (DGAK, MGBA, KMGBA, NDGFA), KLBA, Maseno University

Gap

Validating results with a variety of basal and supplementary feeds

2.4.5 Feeding a Breeding Buck

2.4.5 TIMP name	**Feeding a breeding buck**
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Poor buck fertility due to inadequate quality feeds during mating period
What is it? (TIMP description)	It is the planned provision of adequate quality feeds to the buck especially two months before mating and during the mating season (100-150 g concentrate). In addition, the buck is allowed to rest for about 3 hours a day under intense feeding to replenish its feed reserves for fertility maintenance.

	 Healthy buck Source: KALRO
Justification	A buck constitutes about a half of the dairy goat population in value (as a breed) in a locality. Lack of continuous buck activity therefore negatively affects the productivity of the does in the locality, occasioning long kidding intervals. An underfed buck may lack libido while an overfed buck may be inactive or too heavy for does. Feeding bucks at maintenance level when off mating season, and enhancing feeding during the mating season ensures continuous births of replacement stock.
Region promoted	Kisumu, Kakamega, Kericho, Garrissa, Tharaka Nithi, Kitui and Taita Taveta (TOTs)
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Extension agents and farmers
Approaches used in dissemination	• Training of CIGs, Farmers, ToTs, FFBS, On-farm demonstrations • Exhibition, Agricultural shows, regular localized meetings, demonstration plots • Use of digital platforms • Print media promotional materials (posters, brochures, leaflets, pamphlets and manuals) • Mass media and Web material's, Mobile Apps and SMS, Digital platforms • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Public and private agricultural extension services
Critical/essential factors for successful promotion	Capacity building of service providers and farmers

Partners/stakeholders for scaling up	• County Government Agricultural staff (identifying and organizing the farmer groups) • Local NGO in livestock VCs (community mobilization and training), farmer association group members • KALRO (capacity building and backstopping on critical periods of intense feeding)
C: Current situation and future scaling up	
Counties where TIMPs will be upscaled	Meru, Embu, Homa Bay, Nyeri, Kirinyaga, and Migori counties.
Challenges in dissemination	• Complaints by farmers of inactive bucks even when well fed
Recommendations for addressing the challenges	• Having a veterinarian to inspect and treat the buck where necessary • Expose buck to does early like at one year of age.
Lessons learned	• Bucks that have stayed for long without does may lose interest in mating
Social, environmental, policy and market conditions necessary	• Buck rotation programmes in dairy goats rearing to avoid inbreeding • An understanding of the nutritional basis for low conception rates • A favourable policy on importation of breeding bucks
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	A buck may cost KES 15,000-25,000 and increase household income.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have low access to land to implement the management practice • Women have low access to finances to buy the required inputs • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services • Men dominate decisions on livestock production at the household level
Gender related opportunities	• Employment opportunities for male youth exist in feeding the bucks
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have low access to agricultural information, technology and knowledge • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities

	• There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Employment opportunities for VMGs in caring for bucks and maintaining a breeding programs VMGs can access credit from Hustler fund to purchase high quality feeds for bucks
E: Case studies/profiles of success stories	
Success stories	Market links for sale of breeding bucks in some areas
Application guidelines for users	A manual (Semenye, P. P., H. A. Fitzhugh and W. R. Getz. (1992). Nutrition and management. In: Semenye, P. P. and Hutchraft, T. (Eds.). (1992). *Onfarm Research and Technology for Dual Purpose Goats***.** Small Ruminant Collaborative Research Support Program, Kenya. National Pring Press ltd., Kisumu, Kenya, 1992. ISBN 9966-879-06-4)
Status of TIMP	Information ready for upscaling.
F: Contacts	
Contacts	KALRO Dairy Research Institute, Box 25 (20117) Naivasha, karinaivasha@gmail.com; Pwani University, Box 195 (80100) Kilifi, pattersonsemenye@gmail.com
Lead organization and scientists	KALRO DAIRY RESEARCH INSTITUTE – NAIVASHA, Mr J.N. Kiura, Dr. E. Ilatsia, Dr R. W. Weinaina
Partner organizations	County Governments, Dairy Goat Farmer Group Associations (DGAK, MGBA, KMGBA, NDGFA)

Gap

Monitoring sex hormone levels for bucks kept without does from the age of 9 months to 2 years and relate it to buck (in) activity.

2.4.6 A home-made ration for lactating dairy goats

2.4.6 TIMP name	A home-made ration for lactating dairy goats
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	• Low milk productivity due to poor quality feed supplements • High commercial concentrates

What is it? (TIMP description)	This is a home-made feed ration made by mixing a forage legume (*Leucaena leucocephala*) as a protein source with crude protein of approximately 25% and maize germ, a cereal by-product as an energy source to supplement basal roughage diet. Goats are allowed to feed on the basal diet to their satisfaction and in addition provided with 300 g of supplement per goat per day. The home made ration is fomulated to consist of 40% *L. leucocephala* and 60% maize germ on DM basis.   Leucaena forage Goat eating Leucaena Hay ration Source: KALRO
Justification	Feeding dairy goats on basal roughage diet alone does not meet the nutritional requirements of dairy goats. Farmers do not supplement their dairy goats due to high cost of commercial concentrates. The roughage diet is lower in crude proteins and does not support productivity. Supplementing dairy goats with a home made ration made from *L. leucocephala* with 25% CP and maize germ is optimal milk production. There is no recommended concentrate supplement to basal diet for dairy goats in Kenya. Despite this, Napier grass remains the main basal diet in areas where dairy is predominantly practiced. A supplement made using locally available Leucaena forage as a protein source and maize by-product (maize germ) as an energy source has been proven to increase milk yield by 29%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy goat farmers, dairy goat farmer groups, agricultural service providers/extension agents, agri-preneurs and researchers
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models

	• Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals
Critical/essential factors for successful promotion	• Knowledgeable farmers who understand how to make home made rations • Availibility of forage legumes to be used in formulated home made rations
Partners/stakeholders for scaling up and their roles	• Farmers- to provide ingredients for formulating rations and users of the rations • County Governments – extension services; identifying and organizing the farmer groups • Dairy goat farmer groups – assist in accessing the farmers • KALRO – validating rations, capacity building and backstopping on combinations of various forage types • Agro dealers and millers – to provide access to raw materials such as maize germ • KEBs - standardization and certification for commercialization purposes
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate knowledge on how to formulate rations • Low adoption fodder trees in some areas • Limited extension materials on home made rations • Inadequate staff with dairy goats management knowledge
Suggestions for addressing the challenges	• Capacity build farmers and farmer groups on techniques for formulating home made rations • Awareness creation on the importance of establishing forage legumes and legume trees • Develop and avail dissemination materials on home made rations • Provision of fodder seed for expansion of fodder area • Using the locally available forages that are used as basal feeds • Use of locally available forages with high protein content

	• Training the front-line extension staff and leaders of dairy goat group organizations
Lessons learned in upscaling if any	• Farmers are keen to have low cost and effective feed rations that improve their milk production
Social, environmental, policy and market conditions necessary for development and upscaling	• Dairy goats could be well accepted due to lower feed requirements as land holdings are small, milk could enhance food availability at household level • Use of legumes lowers methane and other green house gas emissions and are thus environment friendly • Goat forages may be grown as part of soil conservation measure thus making the enterprise environmentally friendly. • Growing of forage legumes should be done using KEPHIS approved seeds • Goat milk is a legally accepted product for sale in Kenya • Goat milk and its products have a niche market due aroma and health benefits to humans though this knowledge is not widely upscaled
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs of the TIMP	The cost is expected to be lower than the cost of dairy meal at KES 42/kg (KES 12.60 for 300 g for goats) due to availability of fodder legumes on farm. However there is the cost of initial Leucaena seed (1 kg) is about KES 2,000.
Estimated returns using the TIMP	Increase of milk production by 29% per goat per day or 1.3 litres for a goat producing 1 litre; KES 60/day at a price of KES 200/ litre, leading to increased household income.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have limited access to land to implement the technology, however most women have user land rights, and land requirements by dairy goats are minimal • Women may have limited access to finances to buy the required inputs • Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services. • Men dominate decisions on livestock production at the household level • Technology may increase workload for women and reduce adoption, however women are involved in cutting and carrying feeds to dairy goats, their milking and milk sales
Gender related opportunities	Hustler fund, table banking and micro-finance institution opportunities exist for women to access the required credit for fodder seed and cereal by-products

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to agricultural information, technology and knowledge • VMGs may have limited access to finances to buy the required inputs • VMGs have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	Hustler fund, table banking and micro-finance institution opportunities exist for VMGs to access the required credit for fodder seed and cereal by-products
E: Case studies/profiles of success stories	
Success stories	None
Application guidelines for users	J. N. Kiura, P. Leparmarai, R. Waineina, E. Ilatsia and J. O. Ondiek, 2022. Climate smart dairy goat husbandry support systems for improved livelihoods of small-scale dairy farmers. End of KCSAP project report). Report available in KALRO
Status of TIMP	Technology for validation
F: Contacts	
Contacts	Institute Director, KALRO-Naivasha P.O. Box 25 -20117 Naivasha, Kenya
Lead organization and scientists	DRI-Naivasha - Mr J.N. Kiura, Dr P. Leparmarai, Dr. E. Ilatsia, Dr R. W. Weinaina. Egerton University - Prof. J.O Ondiek
Partner organizations	County Governments, Dairy Goat Farmer Group Associations (DGAK, TNGB, MGBA, KMGBA, NDGFA)

Gap
Validating results using other protein-rich forages besides Leucaena, such as sweet potato vines and Lucerne

2.5 Dairy Goat Housing

2.5.1 Dairy goats housing

2.5.1 TIMP name	Dairy goats housing
Category (i.e., technology, innovation or management practice)	Management Practice

	 Source: KALRO
A: Description of the technology, innovation or management practice	
Problem addressed	Inappropriate goat housing leading high cases of predation, high cost of treating helminthiasis and pneumonia
What is it? (TIMP description)	Dairy goats are housed different types of houses. The hosues should be secure enough to prevent goats from getting attacked by predators, warm and properly ventilated. In addition, a goat house should have a slatted floor which raised to about 1 m above the ground to allow droppings to fall to reduce accumation of fleas and helminth eggs. The house should have sides covered to allow free aeration but prevent flow of strong winds through the house which predisposes goats to pneumonia. The house should be built along the east-west axis to manage sunlight and wind flow through the house. The house should be near living quarters to keep off thieves.
Justification	Good dairy goat housing enhances their productivity through controlling fleas, helminths and pneumonia which are the most serious pest and disease constraints in dairy goats. The goat housing should be warm and should be able to prevent pneumonia.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Extension agents, agri-preneurs and farmers
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print

	• Publications-posters/brochures/leaflets, manuals • Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of artisans to build goat houses • Availability of cost-effective locally available building materials
Partners/stakeholders for scaling up and their roles	• County Governments - extensions, mobilization, identifying and organizing the farmer groups • Local NGO in livestock VCs - community mobilization and training • KALRO – capacity building and backstopping on various materials usable for house construction • Artisans- building houses
C: Current situation and future scaling up	
Counties where already promoted if any	Vihiga and Siaya
Counties where TIMPs will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	Expensive goat house construction material due to prohibition on logging
Suggestions for addressing the challenges	Use of locally available material such as tree branches, offcuts, mud for sides and grass thatch/makuti
Lessons learned	Farmers in areas where dairy goats had been promoted were aware of the basic house requirements of a raised slatted floor goat house
Social, environmental, policy and market conditions necessary	• Goat housing is well accepted to the extent of keeping goats in kitchen • Cutting of trees for constructing goat houses may negatively impact the environment • Construction of goat houses should be in conformity of environmental safeguards by NEMA and be in adherence to the building code of ethics • Goat construction materials to be outsourced outside the farm are readily available in the market
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	• Not determined

Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have limited access to finances to buy the required inputs • Dairy goats' houses are usually constructed by men • Women may have limited access to dairy goat housing information and knowledge • Women may have limited access to education, training and extension services • Men dominate decisions on livestock production at the household level
Gender related opportunities	• Hustler fund opportunities exist for women to access credit for required house construction materials • Employment opportunities exist for youth males in constructing the dairy goat houses
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to agricultural information, technology and knowledge • VMGs may have limited access to finances to buy the required inputs • VMGs may have limited access to education, training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Hustler fund opportunities exist for VMGs to access the required credit for acquiring materials for house construction • Employment opportunities exist for youth males in constructing the dairy goat houses
E: Case studies/profiles of success stories	
Success stories	None
Application guidelines for users	Semenye, P. P., H. A. Fitzhugh and W. R. Getz. (1992). A training manual.. Nutrition and management. In: Semenye, P. P. and Hutchraft, T. (Eds.). On-farm *Research and Technology for Dual Purpose Goats***.** Small Ruminant Collaborative Research Support Program, Kenya. National Printing Press ltd., Kisumu, Kenya, 1992. ISBN 9966-879-06-4)
F: Status of TIMP Readiness	Ready for upscaling
G: Contacts	
Contacts	KALRO Dairy Research Institute, Box 25 (20117) Naivasha,; Pwani University, Box 195 (80100) Kilifi
Lead organization and scientists	KALRO (Mr J.N. Kiura, Dr. E. Ilatsia, Dr R. W. Weinaina)
Partner organizations	County Governments, Dairy Goat Farmer Group Associations (DGAK, TNGB, MGBA, KMGBA, NDGFA)

Gaps

1. Validating house designs based on zones with different wind, temperature and rainfall regimes.
2. Conducting costs and returns of technology.

2.6 Value Addition

2.6.1 Pasteurized goat milk

2.6.1 Technology name	**Pasteurized goat milk**
Category (i.e. Technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	• Low prices of raw milk • Post-harvest milk losses due to lack of ready market which worsen during glut • Food borne hazards associated with consumption of raw milk
What is it? (TIMP description)	Pasteurization is a process in which milk is subjected to heat treatment to eliminate bacteria which cause spoilage and spread foodborne diseases. Milk is pasteurized using the Batch method at 63^{o}C for 30 minutes. Similarly, milk may be pasteurized at high temperature (72^{o}C) for 15 seconds also called short time method (HTST) or flash pasteurization.
Justification	Raw goat not only fetches relatively lower income but is also highly perishable. Pasteurization increases the value of goat milk with a profit of up to 25% realized Pasteurized milk can be preserved for up to 6 months depending on the processing method and packaging used.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy farmers, farmer groups, dairy entrepreneurs, county extension officers and researchers
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural Innovation Platforms (AIP) • Demonstrations - on-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/seminars/meetings • Public and private extension agents • Farmer to farmer extension models • Mass media – electronic and print • Publications-posters/brochures/leaflets, manuals

Critical/essential factors for successful promotion	• Consumer awareness and preferences for safe and high-quality dairy products • Appropriate training on pasteurization • Willing to pay slightly higher prices for pasteurized milk
Partners/stakeholders for scaling up and their roles	• Kenya Dairy Board - regulations on milk handling and sale • Public health - provision of medical and premise certificates • Cooperatives - providiton of market and aggregation services • Extension service providers - training and capacity building • KEBS – product certification • Farmers and Farmer groups - production of milk and identification of markets among members internally and externally • County governments - support viable groups to undertake milk pasteurization services • Milk processors- process milk into different products
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit, Isiolo,Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate extension services • Preference for raw milk consumption in rural areas • Inadequate awareness on the benefits of pasteurized milk
Recommendations for addressing the challenges	• County governments to liaise with other stakeholders for extension and training • Sensitization on the food safety hazards associated with consumption of raw milk • Develop promotional materials to create awareness and influence attitude change on pasteurized milk
Lessons learned	• Pasteurization increases shelf-life and reduces post-harvest losses • Pasteurized milk attract better prices compared to raw milk

Social, environmental, policy and market conditions necessary	• Farmers willing to adopt new practices and change their behavior • Availability of processing and pasteurization facilities • Policy and regulatory framework to enforce pasteurization standards and ensure compliance with safety and quality regulations • Consumer awareness and preferences for safe and high-quality dairy products • Market linkages to quarantee sale of pasteurized goat milk
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production per litre of pasteurized goat milk is between KES 215 and 250 per litre
Estimated returns	A litre of pouched pasteurized goat milk retails at KES 350-400 with a return of between KES 80 -100.
Gender issues and concerns in development, dissemination and adoption and scaling up	• Women have limited access to resources such as dairy goats and land for keeping them • Women have limited access to information, technology and knowledge on value addition in milk • Women and youth have limited access to education, training and extension services. • Women and youths may have limited access to credit to purchase required equipment
Gender related opportunities	• Employment opportunity exist for women and youth in the sale pasteurized milk. • Hustler funds is available for women and youth to access the required credit
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to information and knowledge on how the technology • 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	• Hustler funds exist for VMG to access the required credit • Employment opportunity exist VMG in the sale of pasteurized goat milk
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Milk value addition farmer booklet available at KALRO Ol Joro Orok.

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- DRI, P.O Box 25- 20117, Naivasha Email: director.dri@kalro.org Tel +0202390930
Lead organization and scientists	N.N Kanegeni, E. Macharia and N. Mathai
Partner organizations	County government of Nyandarua, KDB, KEBS, Public health

2.6.2 Yoghurt

2.6.2 Technology name	**Yoghurt**
Category (i.e. Technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	• Low prices of raw milk • Post-harvest losses due to lack of ready market which worsen during glut • Short shelf life of raw milk • Raw milk can be a source of food borne illnesses and digestive disorders
What is it? (TIMP description)	Yoghurt is milk that is fermented within optimum bacterial growth temperatures of 35-45 ºC and cultured with lactic acid-producing, heat tolerant bacteria. The most common and well-known strains of bacteria for yoghurt production are *Lactobacillus delbrucaii bulgaricus* and *Streptococcus thermophilus* among others. These probiotic bacteria are good in the improvement of gut microbiota and improves digestion.
Justification	Raw milk fetches relatively low income and is highly perishable. Post-harvest milk losses are common especially during glut hence. Processing of raw milk into yoghurt, increases milk value by 40% and increases shelf life up to 45days depending on the packages used. Yoghurt is made after pasteurizing milk to destroy or deactivate microorganisms and enzymes that contribute to food spoilage or risk of disease. The pasteurized milk is then fermented to add flavour. Yoghurt is

	also dense with probiotic microbes that promote digestion and essential nutrients bioavailability.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy farmers, farmer groups, agri-preneurs, county extension officers and researchers
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms – Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Consumer awareness and preferences for safe and high-quality dairy products • Appropriate training on yoghurt making • Willing to pay slightly higher prices for value added milk products
Partners/stakeholders or scaling up and their roles	• Kenya Dairy Board - regulations on milk handling and sale • Public health - provision of medical and premise certificates • Cooperatives - providiton of market and aggregation services • Extension service providers - training and capacity building • KEBS – product certification • Farmers and Farmer groups - production of milk and identification of markets among members internally and externally • County governments - support viable groups to undertake milk pasteurization services. • Milk processors- process milk into different products
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit, Isiolo, Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii,

	Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate extension services • Preference for raw milk consumption in rural areas • Inadequate awareness on the benefits of processed milk
Recommendations for addressing the challenges	• County governments to liaise with other stakeholders for extension and training • Sensitization on the food safety hazards associated with consumption of raw milk • Develop promotional materials to create awareness and influence attitude change on processed milk and milk products
Lessons learned	• Milk processing increases shelf-life and reduces post-harvest losses • There is ready market for value added milk products
Social, environmental, policy and market conditions necessary	• Willingness of farmers to adopt the technology • Social acceptability of yoghurt from goat milk • Favourable policy and effective regulatory framework to ensure the safety and quality of dairy products, including adherence to hygiene and labeling standards. • A stable and growing market demand for goat milk yoghurt.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of producting a litre of goat milk yoghurt is estimated at between KES 260-300. However, this may vary depending on cost of raw milk, ingredients and other consumables.
Estimated returns	Goat milk yoghurt sells at an average of KES 550-600 per litre translating to a net return of about KES 290- 300/litre
Gender issues and concerns in development, dissemination and adoption and scaling up	• Women have limited access to resources such as dairy goats and land for keeping them • Women have limited access to information, technology and knowledge on value addition in milk • Women and youth have limited access to education, training and extension services. • Women and youths may have limited access to credit to purchase required equipment
Gender related opportunities	• Employment opportunity exist for women in processing goat milk into yoghurt • Hustler funds are available for women and youth to access the required credit
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to information and knowledge on how the technology • 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	• Employment opportunity exist for VMG in processing goat milk into yoghurt • Hustler funds are available for VMG to access the required credit
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Milk value addition farmer booklet available at KALRO Ol Joro Orok.
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- DRI, P.O Box 25- 20117, Naivasha Email: director.dri@kalro.org Tel +0202390930
Lead organization and scientists	N.N Kanegeni, E. Macharia and N. Mathai
Partner organizations	County government of Nyandarua, KDB, KEBS, Public health

2.6.3 Maziwa lala

2.6.3 Technology name	***Maziwa lala***
Category (i.e. Technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	• Low prices of raw milk • Post-harvest losses due to lack of ready market which worsen during glut • Short shelf life of raw milk • Digestive related disorders and mineral nutrients deficiency
What is it? (TIMP description)	*Maziwa lala* is a fermented milk that is produced through the activity of lactic acid bacteria at an optimum temperature of 25-36 ^{o}C. Milk for production of *maziwa lala* is first pasteurized to destroybacteria that cause spoilage and foodborne illnesses before its fermented. *Maziwa lala* contains

	beneficial bacteria (probiotics) which are good for the improvement of gut microbiota and improves digestion.
Justification	Raw milk fetches relatively low income and with the rising cost of production, the profit margin continues to narrow. Due to the perishability of raw milk, post-harvest milk losses also happen due to lack ready market for the raw milk which may worsen during seasons of milk glut. Making m*aziwa lala* increases value of raw milk with potential to realize profit of over 90%. *Maziwa lala* has a shelf-life of up to 45 days when stored stored under the recommended storage conditions depending on the processing method and packaging used. Pasteurization of milk for *Maziwa lala* destroys or deactivates microorganisms and enzymes that contribute to food spoilage or risk of disease. *Maziwa lala* also contains beneficial bacteria (probiotics) that promote digestion and essential nutrients bioavailability.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy farmers, farmer groups, and agri-preneurs
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Consumer awareness and preferences for safe and high-quality milk products • Appropriate training on making *Maziwa lala* • Willing to pay slightly higher prices for value added milk products
Partners/stakeholders for scaling up and their roles	• Kenya Dairy Board - regulations on milk handling and sale • Public health - provision of medical and premise certificates • Cooperatives - providiton of market and aggregation services • Extension service providers - training and capacity building • KEBS – product certification

	• Farmers and Farmer groups - production of milk and identification of markets among members internally and externally • County governments - support viable groups to undertake milk pasteurization services. • Milk processors- process milk into different products
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit, Isiolo,Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate extension services • Preference for raw milk consumption in rural areas • Inadequate awareness on the benefits of *Maziwa lala*
Recommendations for addressing the challenges	• County governments should liaise with other stakeholders for extension and training • Create awareness about the dangers associated with consumption of raw milk • Develop promotional materials to create awareness and influence attitude change on consumption of *Maziwa lala*
Lessons learned	• There is a ready market for value added dairy products such as *maziwa lala* • *Maziwa alala* has a longer shel-life (up to 45 days) • *Maziwa lala* fetches better prices compared to raw milk
Social, environmental, policy and market conditions necessary for development and upscaling	• Farmers' willingness to participate and adopt the technology • Social acceptability of Goat *Maziwa lala* • An effective regulatory framework should be in place to ensure the safety and quality of goat *Maziwa lala*, including adherence to hygiene and labeling standards. • Good milk market: A stable and growing market demand for Goat *Maziwa lala*.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production per litre of *Maziwa lala* from goat milk is between KES 250 and 350 per litre. However, this may vary depending on cost of raw milk, ingredients and other consumables.

Estimated returns	Sales price per litre of *Maziwa lala* from goat milk is between Kes 450-500 with an estimated net return of between Kes 150-200.
Gender issues and concerns in development, dissemination and adoption and scaling up	• Women have limited access to resources such as dairy goats and land for keeping them • Women have limited access to information, technology and knowledge on value addition in milk • Women and youth have limited access to education, training and extension services. • Women and youths may have limited access to credit to purchase required equipment
Gender related opportunities	• Employment opportunity exist for women in processing goat milk into *Maziwa lala* • Hustler funds are available for women and youth to access the required credit
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to information and knowledge on how the technology • 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	• Employment opportunity exist for VMG in processing goat milk into *Maziwa lala* • Hustler funds are available for women and youth to access the required credit
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Milk value addition farmer booklet available at KALRO Ol Joro Orok.
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- DRI, P.O Box 25- 20117, Naivasha Email: director.dri@kalro.org Tel +0202390930
Lead organization and scientists	N.N Kanegeni, E. Macharia and N. Mathai

Partner organizations	County Government of Nyandarua, KDB, KEBS, Public health

2.6.4 Cheese

2.6.4 TIMP name	**Cheese**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	• Low prices of raw milk • Post-harvest milk losses due to lack of ready market which worsen during glut • Raw milk is highly perishable • Malnutrition related issues associated with consumption of unprocessed milk
What is it? (TIMP description)	Cheese is a dairy product produced in a range of flavors, textures, and forms by coagulation of casein (milk protein). It comprises proteins and fat from milk of cows, buffalo, goats or sheep. During production, milk is usually acidified and either the enzymes of rennet or bacterial enzymes with similar activity are added to cause the casein to coagulate. The solid curds are then separated from the liquid whey and pressed into finished cheese in the Cheese vat. A Cheese vat is a seamless stainless steel vessel or tub in which the curd is formed and cut or broken in cheese making. Some cheeses have aromatic molds on the rind, the outer layer, or throughout. Size of cheese may vary depending on milk quantities. The curd also undergoes cutting, pressing, molding and salting. Cheese is highly dense with calcium, vitamins A, D, K and zinc which contribute to bone health. Cheese is valued for its portability, long shelf life, and high content of fat, protein, calcium, and phosphorus. Cheese is more compact and has a longer shelf life than milk, although how long a cheese will keep depends on the type of cheese.  Cheese

	Source: KALRO
Justification	Raw milk fetches relatively low income and with the rising cost of production, the profit margin continues to narrow. Due to the perishability of raw milk, post-harvest milk losses are also high as there may not be ready market for raw milk. This may worsen during seasons of milk glut. Making cheese, from raw milk results in profit realization of over 90% with an extented shelf-life of up to 14 days for the unripened cheese and up to 2 years for the ripened cheese depending on type of cheese and storage conditions. Consumption of cheese reduces bone related conditions such as rickets and osteoporosis due to its high content of calcium, vitamins A, D, K and zinc.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy farmers, farmer groups, agri-preneurs, county extension officers and researchers
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Consumer tastes and preferences for value added dairy products such as cheese • Good milk market: A stable and growing market demand for value added dairy products • Educating consumers about the benefits of cheese, including its nutritional value and health advantages, to create demand for these products • Appropriate training and demonstration sites Availability of extension services
Partners/stakeholders for scaling up and their roles	• Kenya Dairy Board - regulations on milk handling and sale • Public health - provision of medical and premise certificates • Cooperatives - providiton of market and aggregation services • Extension service providers - training and capacity building • KEBS – product certification

	• Farmers and Farmer groups - production of milk and identification of markets among members internally and externally • County governments - support viable groups to undertake milk pasteurization services. • Milk processors- process milk into different products
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit, Isiolo, Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in development and Dissemination	• Inadequate extension services • Preference to raw milk consumption in rural areas and poor altitude towards consumption of cheese • Inadequate awareness on the benefits of cheese
Recommendations for addressing the challenges	• County governments should liaise with other stakeholders for extension and training • Awareness creation about the risk of consuming raw milk contaminated with foodborne causing bacteria. • Develop promotional materials to create awareness and influence attitude change on consumption of cheese
Lessons learned	• There is a ready market for value added dairy products products such as cheese • Cheese has a longer shel-life (up to 14 days to 2 years) • Cheese Ready market for value added products exist
Social, environmental, policy and market conditions necessary for development and promotion	• Willingness to adopt cheese • Understanding of consumer preferences for cheese flavor, textures, and packaging to meet market demands. • Social acceptability of cheese • Adherence to proper waste management • An effective regulatory framework should be in place to ensure the safety and quality of cheese including adherence to hygiene and labeling standards. • Policies that promote adherence to quality control and safety standards
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	Cost of production of a kilo of cheese from goat milk is between KES2,500 and 2,800. However, this may vary depending on cost of raw milk, ingredients and other consumables.
Estimated returns	Selling price per kilo of cheese from goat milk is about KES 5,000 with an estimated net return of between KES 2,200 to 2500 per kg
Gender issues and concerns in development, dissemination and adoption and scaling up	• Women have limited access to resources such as dairy goats and land for keeping them • Women have limited access to information, technology and knowledge on value addition in milk • Women and youth have limited access to education, training and extension services. • Women and youths may have limited access to credit to purchase required equipment
Gender related opportunities	• Employment opportunity exist for women in processing milk into cheese • Hustler funds exist for women and youth to access the required credit
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may have limited access to information and knowledge on processing milk into cheese • VMGs may 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	• Employment opportunity exist for VMG in processing goat milk into cheese • Hustler funds are available for VMG to access the required credit
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for Users	Milk value addition farmer booklet available at KALRO Ol Joro Orok.
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- DRI, P.O Box 25- 20117, Naivasha Email: director.dri@kalro.org

	Tel +0202390930
Lead organization and Scientists	N.N Kanegeni, E. Macharia and N. Mathai
Partner organizations	County government of Nyandarua, KDB, KEBS & Public health

2.6.5 Butter

2.6.5 Technology name	**Butter**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	• Low prices of raw milk • Post-harvest milk losses due to lack of ready market • Mineral nutrients deficiency
What is it? (TIMP description)	Butter is a fatty product exclusively from milk consisting of approximately 80% milk fat, maximum 2% milk solids not fat and 16% water. Different types of butter are categorized on basis of type of cream (sweet cream and sour cream) and salt content (salted and unsalted). Butter is very rich in Vitamin D and calcium, nutrients vital for bone growth and development.
Justification	Raw milk fetches relatively low price and with the rising cost of production, the profit margin continues to narrow. Due to the perishability of raw milk, post-harvest milk losses are also high since there may not be ready market. The losses may worsen during milk glut season. Butter making may result in over 95% profit realization with a shelf-life of up to 2 months when stored under the recommended storage conditions. Butter has high levels of Vitamin D and calcium and so consumption of this is effective in the prevention of bone related issues such as osteoporosis and rickets.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy farmers, farmer groups, dairy agri-preneurs, extension officers and researchers
Approaches used in Dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print

	• Publications-posters/brochures/leaflets, manuals • Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Consumer awareness about the benefits of butter, including its nutritional value and health advantages, to create demand • Good milk market: A stable and growing market demand for dairy value added products • Availability of extensiom services
Partners/stakeholders for scaling up and their roles	• Kenya Dairy Board - regulations on milk handling and sale • Public health - provision of medical and premise certificates • Cooperatives - providiton of market and aggregation services • Extension service providers - training and capacity building • KEBS – product certification • Farmers and Farmer groups - production of milk and identification of markets among members internally and externally • County governments - support viable groups to undertake milk pasteurization services. • Milk processors- process milk into different products
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit, Isiolo,Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate extension services • Preference to raw milk consumption in rural areas and poor altitude towards butter consumption • Inadequate awareness on the benefits of butter
Recommendations for addressing the challenges	• County governments should liaise with other stakeholders for extension and training • Create awareness on the risks associated with consumption of raw milk

	• Develop promotional materials to create awareness and influence attitude change on consumption of butter
Lessons learned	Ready market for value added products exist
Social, environmental, policy and market conditions necessary for development and adoption	• Willingness to process milk into butter • Understanding of consumer tastes and preferences for butter flavor, textures, and packaging to meet market demand • Adherence to proper waste management • An effective regulatory framework should be in place to ensure the safety and quality of butter including adherence to hygiene and labeling standards • Policies that promote adherence to quality control and safety standards
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production a kilogram of butter from goat milk is about KES 1,700. However, this may vary depending on cost of raw milk and other consumables.
Estimated returns	Selling price of a kilogram of butter from goat milk is approximatelty KES 4,000 with an estimated net return of about KES 2,300 per kg.
Gender issues and concerns in development, dissemination and adoption and scaling up	• Women have limited access to resources such as dairy goat, capital and land • Women have limited access to information and knowledge on processing goat milk into butter • Women and youth have limited access to education, training and extension services. • Women and youths may have limited access to credit to purchase required inputs
Gender related opportunities	• Employment opportunity exist for women in processing goat milk into butter • Hustler funds are available for women and youth to access the required credit
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to information and knowledge on processing goat milk into butter • 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	• Employment opportunity exist for VMG in processing milk into butter • Hustler funds are available for VMG to access the required credit

E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Milk value addition farmer booklet available at KALRO Ol Joro Orok.
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- DRI, P.O Box 25- 20117, Naivasha Email: director.dri@kalro.org Tel +0202390930
Lead organization and scientists	N.N Kanegeni, E. Macharia, N. Mathai
Partner organizations	County Government of Nyandarua, KDB, KEBS, Public health

2.6.6 Ghee

2.6.6 Technology name	**Ghee**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	• Low prices of raw milk • Post-harvest milk losses due to lack of ready market • Mineral nutrients deficiency
What is it? (TIMP description)	Ghee is a milk product obtained from butter or cream by elimination of water and solids not fats through decantation or evaporation. Its composition is equal to or more than 99% fat and < 1% water. Ghee contains high concentrations of monounsaturated Omega 3 fatty acids which possess beneficial to health as they strengthen the heart and cardiovascular system.

	 Ghee Source: KALR
Justification	Raw milk fetches relatively low income and with the rising cost of production, the profit margin continues to narrow. Due to the perishability of raw milk, post-harvest losses are high since there is no ready market. This may worsen during milk glut periods. Making ghee from goat milk increases value of product to over 150%. Ghee production ensures less wastage and enhances profits by over 80%. Ghee has a shelf-life of up to 6 months when stored under the recommended storage conditions. The high concentrations of monounsaturated Omega 3 fatty acids in ghee promote healthy heart and cardiovascular system and also minimizes the intake of unhealthy cholesterol.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy farmers, farmer groups, agri-preneurs, extension officers and researchers
Approaches used in Dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Consumer awareness and preferences for ghee Appropriate training and demonstration sites

	• Market linkages and distribution channels to incentivize farmers to adopt Ghee production technology. • Appropriate training and demonstration sites Availability of extension services
Partners/stakeholders for scaling up and their roles	• Kenya Dairy Board - regulations on milk handling and sale • Public health - provision of medical and premise certificates • Cooperatives - providiton of market and aggregation services • Extension service providers - training and capacity building • KEBS – product certification • Farmers and Farmer groups - production of milk and identification of markets among members internally and externally • County governments - support viable groups to undertake milk pasteurization services. • Milk processors- process milk into different products
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit, Isiolo,Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate extension and trainers at the county-level • Preference to raw milk consumption in rural areas and poor altitude towards ghee consumption. • Inadequate awareness on the benefits of ghee
Recommendations for addressing the challenges	• County governments should liaise with other stakeholders for extension and training • Capacity building of trainers by county governments in liaison with stakeholders • Develop promotional materials to create awareness and influence attitude change on ghee consumption
Lessons learned	• There is a ready market for value added dairy products products such as ghee • Ghee has a longer shel-life (up to 6 months) • Ghee fetches better prices compared to raw milk

Social, environmental, policy and market conditions necessary for development and adoption	• Willingness to make ghee instead of consuming raw milk • Social acceptability of ghee • Adherence to proper waste management • Awareness of the health benefits and economic opportunities associated with ghee • An effective regulatory framework should be in place to ensure the safety and quality of butter including adherence to hygiene and labeling standards. • Policies that promote adherence to quality control and safety standards • Implementation of certification and inspection procedures • Good milk market: A stable and growing market demand for gheeFarmers' willingness to participate and adopt the technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production one kilogram of goat ghee is estimated at KES 1,800. However, this may vary depending on cost of raw goat milk and other consumables.
Estimated returns	Selliong price per kilogram of goat ghee is KES 4,990 with an estimated net return of KES 2,000 per kg.
Gender issues and concerns in development, dissemination and adoption and scaling up	• Women have limited access to resources such as dairy goat, capital and land • Women have limited access to information and knowledge on processing goat milk into ghee • Women and youth have limited access to education, training and extension services. • Women and youths may have limited access to credit to purchase required inputs
Gender related opportunities	• Employment opportunity exist for women in processing goat milk into ghee • Hustler funds are available for women and youth to access the required credit
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to information and knowledge on processing goat milk into ghee • 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	• Employment opportunity exist for VMG in processing goat milk into ghee • Hustler funds exist for VMG to access the required credit

E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Milk value addition farmer booklet available at KALRO Ol Joro Orok.
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- DRI, P.O Box 25- 20117, Naivasha Email: director.dri@kalro.org Tel +0202390930
Lead organization and scientists	N.N Kanegeni, E. Macharia, N. Mathai
Partner organizations	County government of Nyandarua, KDB, KEBS, Public health

2.7 Dairy Goat Health Management

2.7.1 Thermo-tolerant Peste des Petits Ruminants (PPR) Vaccine

2.7.1. TIMP name	**Thermo-tolerant Peste des Petits Ruminants (PPR) Vaccine**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	

Problem to be addressed	Low productivity from increased Peste des Petits Ruminants (PPR) incidence arising from low vaccination coverage and use of the current vaccine which is cold chain dependent.  A goat showing clinical signs of PPR Source: KALRO
What is it? (TIMP description)	This is a live attenuated heattolerant virus vaccine that can be kept at room temperature conditions (20-25^{o}C) for several months; 37^{o}C for 7-14 days). The vaccine is an improvement of currently used Nigerian 75/1 strain PPR vaccine.
Justification	Peste des Petits Ruminants is prevalent in marginalized areas where majority of the small ruminants (goats and sheep) are found. These areas are low on critical infrastructure development including grid power connectivity. Consequently, the use of the existing vaccine which is cold chain dependent is low thus justifying the need for a heat-tolerant vaccine. The use of heat- tolerant vaccine reduces reliance on cold chain during vaccine delivery.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Researchers, DVS, Kenya KEVEVAPI, Pan African Veterinary Vaccine Centre of African Union AU-PANVAC), FAO, extension service providers, agri-preneurs

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Stakeholder participation especially County livestock and veterinary staff, sustainable supply of the vaccine • Meeting the AU/PANVAC quality control standards for thermostable vaccines • Patenting and Registration of the vaccine for local and regional use • Functional working relations/MOU with KEVEVAPI the veterinary vaccines commercial producer • Proper working relationships with County Governments • Incorporation of animal health product regulators (VMD, DVS, NACOSTI, the Kenya Veterinary Board (KVB) into the vaccine development and commercialization process
Partners/stakeholders for scaling up and their roles	• KALRO- technical backstopping during upscaling Research and dissemination • KEVEVAP- vaccine production and distribution • DVS- policy and regulation of vaccine use • County Governments - extension services, awareness creation on vaccine • Non-Governmental Organizations(NGOs)- dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	West Pokot and Turkana
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate infrastructure for vaccine production • Inadequate vaccine distribution network • Acceptability of the vaccine in the country a and in the region

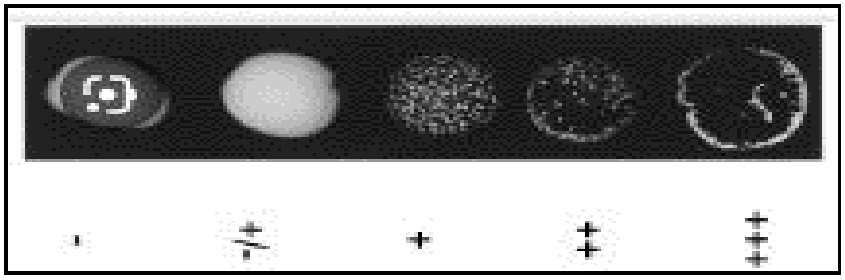
Recommendations for addressing the challenges	• Strengthening the production capacity of KEVEVAPI by lobbying for provision of necessary infrastructure and equipment • Creating awareness and promote the vaccine locally and within the region • Strengthen Public Private Partnerships (PPP) for sustainable distribution of the vaccine • Advocacy for change of socio-cultural practices
Lessons learned in up scaling if any	• The vaccine has a shelf life of up to 14 days under room temperature • Collaborations and partnerships are key for success in vaccine development process. • Involvement of vaccine producer and regulatory institutions such as KEVEVAPI and DVS from initial technology development stages creates a buy-in which is essential during upscaling.
Social, environmental, policy and market conditions necessary for development and up scaling	• Awareness creation on the use of the thermo-tolerant PPR vaccine • Policy framework to guide the incorporation of thermotolerant PPR vaccine in OIE eradication programme for PPR in Kenya and the region • Need to register the vaccine with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies (AU/PANVAC) for marketing and use of the vaccine in Kenya and the region • There is need to lobby DVS to relax the supervision of vaccinations to allow involvement of private service providers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The vaccine confers lifetime immunirty with an estimated cost of KES 35 per aniamal.
Estimated returns	KES 1,000 per animal from reduction in PPR mortality, reduction in treatment cost and lowered production losses
Gender issues and concerns in development, dissemination, adoption and scaling up	• PPR vaccine is administered through injections thus requiring that animals to be properly restrained which may not be favourable for women. • Women may have limited ability to influence decision-making in their household around vaccination and animal health • Women and youth may have limited access to finances necessary to acquire the vaccine

Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit to purchase veterinary vaccines • Knowledgeable women and youth can enter in to the distribution chain for income generation • PPR vaccination will enhance small ruminant productivity for better food, nutrition and incomes for households • Employment opportunities for youth exist in rearing small ruminants
VMG issues and concerns in dissemination, adoption and scaling up	Limited knowledge of vaccine among VMGs who may have low access to agricultural information and extension services
VMG related opportunities	Affirmative action opportunities exist for VMGs to acquire the required credit and access veterinary extension services
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	None at the moment
F: Status of TIMP readiness	Requires validation
(1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	
G: Contacts	
Contacts	KALRO – VSRI, Muguga North P.O. Box 32 - 00902 Kikuyu,
Lead organization and scientists	KALRO VSRI Muguga-Dr. Soi Reuben, Dr. Duncan Ithinji KEVEVAPI, Dr. Alex Sabuni
Partner organizations	KEVEVAPI, DVS, AU- PANVAC, FAO

Gaps

1. Assess the role of camels as reservoirs of PPRV
2. Validate the thermo-tolerant PPR vaccine for use in the control of PPR in small ruminants
3. Determine the cost-benefit of the thermo-tolerant PPR vaccine in the control of the disease
4. Develop and utilize PPR outbreak prediction models for enhanced surveillance of the disease
5. Develop guidelines for successful use of the vaccine
6. Assess development, adoption and scaling up of the technology with gender and VMGs in consideration

2.7.2 Contagious Caprine Pleuro-pneumonia (CCPP) Latex gglutination Test

2.7.2 TIMP name	**Contagious Caprine Pleuro-pneumonia (CCPP) Latex Agglutination Test**
Category (i.e. technology, innovation or management	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity in goats arising from prolonged infection with Contagious Caprine Pleuro-Pneumonia (CCPP) as a result of late detection of the disease due to limitations in the current laboratory based diagnostic tests which are unsuitable for field diagnosis
What is it? (TIMP description)	Contagious Caprine Pleuro-pneumonia (CCPP) Latex Agglutination Test is a simple rapid penside test for identifying goats that have been exposed to CCPP causative organisms. The test uses either whole blood or serum and does not require refrigeration making it suitable for rapid field diagnosis of CCPP in Arid and semi-arid lands (ASALs) where the disease is prevalent.  Plate showing negative and positive LAT results Source: KALRO
Justification	CCPP causes huge economic losses in form of reduced productivity through high mortality in goats. The current tests for detection of CCPP are laboratory-based and delay disease detection thereby increasing losses due to prolonged exposure of animals to disease. In addition, late diagnosis of the disease increases the risk of irrational use of antimicrobials hence the risk of antimicrobial residues (AMR) in animal source foods. The use of CCPP Latex Agglutination Test ensures rapid detection of CCPP for making quick and informed decisions on the use of vaccines/drugs. It can also be used during vaccination to detect exposed animals and decrease incidences of high vaccine failure that result from vaccination infected goats.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy goat keepers, Researchers, Goat traders associations, Goat Breeder associations, DVS, County Governments, private animal health practitioner, extension service providers, agri-preneurs

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of reagents and other consumables • Availability of effective marketing channels for the kit • Adequate infrastructural capacityto produce and supply kits
Partners/stakeholders for scaling up and their roles	• KALRO – to provide technical backstopping and training of trainers • Extension service providers (public and private) – to offer advice and collect information on the uptake of the kit. They will also ensure proper use of the kit. • County Governments- promote and create awareness on the advantages of the kit • DVS and VMD-policy and regulation on use of the kit • Farmers and farmer groups- end- users • AU/PANVAC- quality assurance
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Unavailability of appropriate droppers (10µl) for dispensing the reagents • Large dose packaging • Low awareness of the technology • Inadequate capacity to use the kit by extension workers and pastoralists • Lack of appropriate diagnostic kit marketing channels

Recommendations for addressing the challenges	• Fabricate the right dispenser • Seek alternative dispensing methods • Package in small packs • Promotion to raise awareness of the technology. • Capacity building of extension workers and dairy goat keepers on use of the kit • Collaboration with private institutions to enhance kit production and commercialization.
Lessons learned in up scaling if any	• There is increased accuracy of the kit when the application guideline are followed • The technology does not work well with frozen serum samples
Social, environmental, policy and market conditions necessary for development and up scaling	• Awareness and promotion of the kit • Policy to guide the incorporation of kit in detection and control of CCPP in Kenya • Reegistration of the kit with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies for its use in Kenya and the region
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 10,000 per 100 tests
Estimated returns	Average economic losses due to CCPP in 100 goat herd is KES 171,266 per year
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth have imited financial capacity to purchase the kit • Women and youth have limited knowledge of sheep and goat diseases due to lack of access to agricultural information and extension services • Women and youth have i n adequate skills on diseases management
Gender related opportunities	Improved productivity of goats increases household income leading to more business opportunities for women and youth who keep small ruminants.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to their social status VMGs are often excluded from decision making during dissemination of technologies • VMGs face barriers in accessing information • VMGs face barriers in accessing resources such as credit
VMG related opportunities	• Capacity building and support to be provided toVMGs • Less mortalities and increased productivity hence increased income for VMGs
E: Case studies/profiles of success stories	

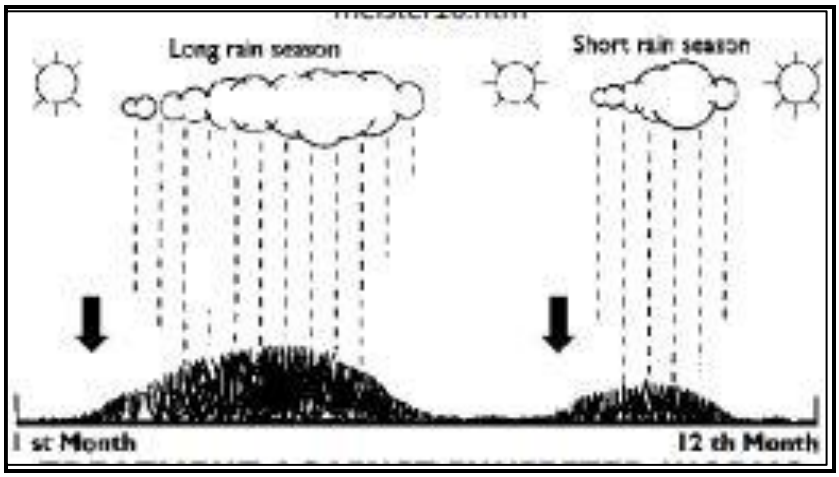
Success stories from previous similar projects	• None
Application guidelines for users	Capritest LAT for CCPP-(Leaflet) – available at Biotechnology Research Centre, Kabete
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Institute Director, Biotechnology Research Institute, KALRO P.O. Box 362-00902 Kikuyu email: director.biori@kalro.org
Lead organization and scientists	KALRO, Dr. Martin K. Mwirigi
Partner organizations	DVS

Gaps

1. Determine the cost-benefit of using the test in the control of CCPP
2. Assess development, adoption and scaling up of the technology with gender and VMGs in consideration
3. On farm validation of the test

2.7.3 Integrated Helminth Control

2.7.3 TIMP name	**Integrated Helminth Control**
Category (i.e. technology, innovation or management	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Low productivity in farm animals including goat, and goats due to high helminth burden • High cost of deworming due to lack of a guideline on sustainably helminth control • Rising incidence of anthelmintic resistance

What is it? (TIMP description)	Integrated helminth control is a strategy where worm control is based on a combination of methods including use of dewormers, pasture management and husbandry practices. Animals are dewormed in times when the risk of helminth infection is high. Deworming is timed to happen shortly before onset of the rains to minimize contamination of pasture with infective helminth eggs which exposes livestock to the risk of re-infection during grazing. Repeat worming should be done at the end of the rainy season so that animals enter the dry season when they are relatively clean.  Seasonal calendar showing critical time to deworm livestock Source: KALRO/DFID
Justification	High prevalence of worms reduces productivity in the red meat and dairy value chains. The irrational use of dewormers results in high resistant worms which increases the burden of controlling worms. The use of the integrated helminth control strategy ensures deworming happens when justifiable thus saves farmers money. It also reduces the speed with which helminths develop resistance to commonly used anthelmintics. Routine deworming as often practiced may result in unnecessary treatments, resistance development.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy goat farmers, Extension Service Providers, Researchers, agri-preneurs

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Use of correct dose, dosing technique and timing. • Policy guideline on regulated use of anthelmintics • Awareness creation on integrated helminth control • Good working relationship and incorporation of DVS and County Governments in development and promotion of the
Partners/stakeholders for scaling up and their roles	• KALRO- research on new and alternative anthelmintic drugs, monitor resistance trends and develop resistance best-bet management options • County Governments - extension services- dissemination of information and ensure proper use of Management practice • Private veterinarians – clinical services • Pharmaceutical companies - supply of anthelmintic drugs • VMD-Registration of new anthelmintic drugs before they go to the market • DVS – regulation of use of anthelmintic drugs • Livestock keepers- end users
C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri and Kericho
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.

Challenges in dissemination	• Inadequate awareness about existence of the integrated helminth control strategy • Proliferation of anthelmintic drug brands in the market some of which are counterfeits • Liberalized market for anthelmintic drugs which is hard to regulate • Under dosing since worming is based on animal live weights • Poor timing for deworming
Recommendations for addressing the challenges	• Create awareness about how the integrated helminth control strategy works • Enforce regulations on registration of to enhance quality • Capacity build farmers and technicians on correct doses, • Develop farmer-friendly guidelines on proper dosing and application of dewormers • Avail simple and easy to use weighing techniques to encourage dosing based on live weight • Ensure worming is done based on season and risk of helminth infection
Lessons learned in up scaling if any	• Deworming can be timed to only be done when needed • Farmers if trained can be able to estimate the weight of their animals as a guide to giving correct anthelmintic drug dosages • Application of the management practice saves unnecessary costs
Social, environmental, policy and market conditions necessary for development and adoption	• Willingness to adopt this practice for control or worms • Policy guidelines on anthelmintic use (in view of animal diseases act (CAP 364) as enforced by DVS) • Regulation on anthelmintic quality to reduce counterfeited anthelmintics in the market
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 40-60/dose of anthelmintic
Estimated returns	The adoption and use of this strategy where you deworm when risk is high will save up to 30% of deworming costs incurred when deworming is done after once after 3 months
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have challenges handling animals especially bucks during deworming • Women have limited access to information and knowledge on the use of integrated helminth control. • Women have limited access to education, training and extension services. • Cultural practices may limit women from performing the task • Women may not be involved in making decision on livestock production and marketing at the household level

Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Employment opportunities for women and youth exist in performing rearing goats whose populatuoin is expected to increase significantly from the use of the technology.
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit in order to mplement the technology • Employment opportunities for VMD exist in rearing goats resulting from benefits of using of the technology
• **E: Case studies/profiles of success stories**	
Success stories from previous similar projects	• High demand for training by farmers on integreated helminth control and extensive use in many agro-ecological zones of Kenya by KARI-DFID (1994-2000) • increased incomes realized from use of integrated helminth control strategy by community sheep breeding groups in Laikipia and Kajiado Counties
Application guidelines for users	KARI-DFID (1999)- Integrated helminth control (Technical Note No. 2)
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Institute Director KALRO – VSRI, Muguga North P.O. Box 32 - 00902 Kikuyu, Kenya
Lead organization and scientists	KALRO VSRI - Muguga Dr. Nginyi J.; KALRO HQts Dr Mungube E.O.
Partner organizations	DVS, Pharmaceuticticals, County Governments, VMD

Gaps

1. Update the strategic helminth guidelines to make them responsive to changes in climatic conditions and land use patterns which have an impact on helminth prevalence.
2. Develop and validate integrated helminth control packages to address rising incidences of anthelmintic resistance and residues in milk and meat.
3. Develop helminth risk maps and assess anthelmintic resistance patterns
4. Assess development, adoption and scaling up of the technology with gender and VMGs in consideration

2.7.4 Push-Pull for tsetse fly control

2.7.2 TIMP name	Push-Pull for tsetse fly control
Category (i.e. technology, innovation or management	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Reduced productivity of goats due to high incidence of trypanosomosis and tsetse fly attack • High cost of controlling trypanosomosis in dairy goats • Ineffective treatment due to increased trypanocidal drug resistance  Tsetse fly (trypanosome vector) Source: KALRO
What is it? (TIMP description)	Push-pull is a technology that uses attractants and repellant chemicals blends to repel or attract tsetse flies away from or to the animal. Repellants keep tsetse flies away from goats thus reducing infection rates while attractants pull tsetse flies to insecticide treated goats ensuring they come into lethal doses of insecticides that kill those that attempt to feed on the animals thus reducing transmission of trypanosomes and reducing the risk of spreading trypanosomosis.
Justification	High incidence of trypanosomosis reduces goat productivity in tsetse infested areas. Over-reliance on and misuse of trypanocides resulted in trypanocidal drug resistance. The use of push-pull enables farmers to keep productive goats in high tsetse infested areas as risk of transmission of trypanosomosis is significantly reduced. This enbales goats to remain productive with little treatment of clinical cases. Push-pull will contribute to building the resilience of the farmers by ensuring trypano-susceptible goat breeds can survive, reproduce and produce milk and kids in high tsetse challenge areas even with no trypanocide treatment.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Dairy goat farmers, extension service providers, researchers, NGOs and CBOs, agri-preneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of effective repellants and attractants • Training on how to use repellants and attractants on goat • Extensively promote the use of push-pull in controlling trypanosomosis • Ensure full involvement of the goat keepers and stakeholders in the dairy goat milk value chain • To avoid counterfeiting, encourage the registration on all chemicals used as repellants and attractants by VMD • Involve DVS for enforcing regulated use of the repellants and attractants
Partners/stakeholders for scaling up	• Kenya Tsetse and Trypanosmiasis Eradication Council (KenTTEC) - surveillance of tsetse fly and trypanosomosis • KALRO – research on tsetse and trypanosomosis control • Universities - research on tsetse and trypanosomosis control • DVS – policy regulations on tsetse and trypanosomosis control • Bio-innovate- funding agency • County Governments - extension services • Goat keepers - end users of the technology
C: Current situation and future scaling up	
Counties where already promoted	Kwale
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.

Challenges in dissemination	• The repellants and attractants not packaged in form for direct use by farmers • Production repellants and attractants is still at pre-industrial level • Low awareness levels on existence and use of the push-pull technology
Suggestions for addressing the challenges	• Packaging of repellants in a form that can easily be used by farmers • Fast tracking of patenting, registration and commercialization of repellants and attractants • Sensitization of farmers and other stakeholders on the availability of repellants and attractants for controlling tsetse flies
Lessons learned in up scaling if any	• Proper use of push-pull technology helps to sustainably and cost-effectively control trypanosomosis in goats reared in high tsetse challenge areas • Repellants and attractants should not be diluted before applying to goats • There is need to involve goat keepers when using the technology • Enhancing the capacity of goat keepers improves the effectiveness of the push pull technology • Always remind farmers not to spray animals applied with attractants and repellants
Social, environmental, policy and market conditions necessary	• Acceptability of the technology among livestock keepers • Need to ensure the use repellants and attractants does not cause environmental pollutions and affect other not target insects • Policy on control of vectors and vector-borne diseases • Market demand for the technology
	• Guidelines on use of attractants and repellants to prevent pollution of the environment especially water masses if not properly done • Policy on quality control of insecticides
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 300/animal per week for treatment with an attractant/repellant
Estimated returns	The spray will prevent 30% loss in goat flocks due to trypanosomosis

Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to information and knowledge on the use of the technology. • Women have limited access to education, training and extension services. • Cultural practices may limit women from performing the task • Women may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit to access the technology • Employment opportunities for women and youth exist in rearing goats whose populatuoin is expected to increase significantly from the use of the technolgy
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit and acces the technology • Employment opportunities for VMG exist in in rearing goats whose populatuoin is expected to increase significantly from the use of the technolgy
E: Case studies/profiles of success stories	
Success stories from previous similar projects	The push-pull technology used on experimental farms in Kwale with 98% protection success on preventing trypanosomosis infection in experimental
Application guidelines for users	Mieji, P.O. et al., 2022. Perspectives on Odor- Based Control of Tsetse Flies in Africa. Frontiers in Physioloy, DOI - 10.3389/fphys.2022.831618
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	

Contacts	Institute Director, KALRO Biotechnology Research Institute Muguga P.O. Box 362 -00902 Kikuyu
Lead organization and scientists	KALRO Biotechnology Research Institute, Muguga- Dr Paul Mreji
Partner organizations	Kenya Tsetse and Trypanosmiasis Eradication (KenTTEC), Council, Kenyatta University, DVS, Bioinnovate, Gulu University, County Governments

Gaps

1. Validate the effectiveness of the technology in suppressing tsetse flies in different livestock production systems
2. Undertake economic analysis to determine the profitability of the technology

2.7.5 Protocol for Controlling Mastitis in Dairy Animals

2.7.5 TIMP Name	**Protocol for Controlling Mastitis in Dairy Animals**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low milk yield and postharvest losses (discarded milk) due to high incidence of sub-clinical mastitis in dairy animals

What is it? (TIMP description)	The protocol involves regular screening of each quarter of the udder of each animal using penside tests like the pH based paper strip kit, strip cup and California Mastitis Test (CMT) just. Screening results will identify, animals infected with mastitis for prompt treatment to minimize loss in milk production.  Screening for subclinical mastitis using CMT Source: KALRO
Justification	High prevalence of subclinical mastitis which can not be detected visually reduces milk output by about 33% and affects milk quality and marketability. Farmers have inadequate knowledge on management of mastitis in dairy animals. The protocol for controlling mastitis encourages regular screening and identification of animals with mastitis for prompt treatment. Healthy udders will produce milk with low somatic cell counts and reduces chances rejection. The protocol aims at minimizing losses in milk production and in milk rejections. It will also ensure marketing of high quality milk and milk products.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy goat farmers, County veterinary and livestock staff, Certified Private animal health practitioners, Kenya Dairy Board (KDB), milk processors. Agri-preneurs

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Farmers awareness of subclinical mastitis in • lactating goats • Willingness by dairy goat farmers to adopt the various testing kit technologies (CMT and pH-based testing methods) • Willingness by milk trader to pay premium price for quality milk delivered by producers
Partners/stakeholders for scaling up and their roles	• KALRO - research and information generation and sharing • Dairy farmers - end users of the technology • County governments - extension services and capacity building. • Universities – research and training • Milk bulkers/ cooperatives - end users and dissemination of information
C: Current situation and future scaling up	
Counties where already promoted if any	Isiolo, Marsabit, and Wajir
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Lack of awareness on subclinical mastitis • Limited supply of the kit and awareness of its use • Inability to access goats given their frequent mobility in search of forage.

Recommendations for addressing the challenges	• Create awareness on effects of mastitis and particularly subclinical on milk production • Capacity building on control and prevention of subclinical • Mastitis • Fast track the refinement, registration and commercialization of the pH based kit to involve farmers in mastitis control • Train goat keepers on use of the simple screening tests for identification of mastitis
Lessons learned in up scaling if any	Involvement of farmers in screening milk animals makes it easier to adopt novel screeing kits
Social, environmental, policy and market conditions necessary for development and up scaling	• Acceptability of the mastitis control protocol among livestock keepers • Policy framework for control of animal disease (CAP 364) • Attractive market for hygienic quality milk with a premium price
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of CMT reagent, labour and treatment with antibiotics gives a total cost of KES 350 per animal
Estimated returns	Up to 33% of milk is saved from loss due to mastitis by using technology
Gender issues and concerns in development and dissemination, adoption and scaling up	• Women and youth have limited access to resources such as credit to purchase testing kits such as California Mastitis Test (CMT) • Women and youth have limited knowledge of animal diseases due to lack of access to agricultural information and extension services
Gender-related opportunities	• Opportunity for youth to be trained in dairy goat health • technologies • Adoption of dairy management technologies will benefit women and youth since there will be increased productivity hence increased income • Increases household income leading to more business opportunities • Food and nutrition security for youth and women
VMG issues and concerns in dissemination, adoption and scaling up	VMGs like the visually impaired persons are disadvantaged since the technology is based on colour visualization
VMG related opportunities	Adoption of mastitis management practice will lead to increased productivity hence increased incomes and improved food and nutrition security for VMGs
E: Case studies/profiles of success stories	

Success stories from previous similar projects	Management of subclinical mastitis has successfully been promoted among the Salato women group in Ngurunit. Marsabit County, Anolei cooperative in Isiolo County.
Application guidelines for users	1.https://www.kalro.org/sites/default/files/Control-mastitis-for-hygienic-goat-milk-Dec2020.pdf 2. Manual for trainers available at KALRO-VSRI, Muguga
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, KALRO – VSRI, Muguga P.O. Box 32 -00902 KIKUYU, Kenya
Lead organization and scientists	KALRO VSRI (Peter Ndirangu and Monica Maichomo), KALRO – SGCRI Marsabit Amos Adongo
Partner organizations	MMUST and Kibabii University

Gaps

1. Validate the effectiveness of protocol for mastitis control in reducing effects of mastitis in dairy animals
2. Undertake social studies to assess the acceptability of levels and willingness to adopt the management practice amongst dairy animal keepers
3. Assess the profitability of adopting the technology by comparing those adopting and those not willing to adopt

2.7.6 Contagious Caprine Pleuro-pneumonia (CCPP) DIVA Vaccine

2.76 TIMP Name	**Contagious Caprine Pleuro-pneumonia (CCPP) DIVA Vaccine**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Low milk productivity due to high mortality arising from prevalence of CCPP disease. • Lack of a commercial DIVA vaccine and assay that can differentiate naturally infected from vaccinated goats.
What is it? (TIMP description)	The CCPP DIVA vaccine is a modification of the current CCPP vaccine through introduction of a protein tag to help differentiate antibodies resulting from exposure to

	disease and vaccination. Antibodies from vaccinated goats will have a tag which is easily detectable,
Justification	Contagious Caprine Pleuropneumonia is a major disease of goats with high mortality rates ranging between 80% and 100% following outbreaks. Vaccination is the most cost-effective method for controlling the disease. World organization of Animal Health (WOAH) has made it mandatory to vaccinate and test goats for export to international markets. The DIVA CCPP vaccine ensures that antibodies in goats arising from vaccination are clearly differentiated from those in goats with antibodies from natural infection. The use of CCPP-DIVA vaccine enhances the productivity of goats as well as trade in livestock and livestock products.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers and farmer goups, county governments, public and private extension service, veterinary service providers and KEVEVAPI, agri-preneurs
Approaches to be used in the dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Functional working relations/MOU with KEVEVAPI the veterinary vaccines commercial producer • Contact with animal health product regulators (VMD, DVS, the Kenya Veterinary Board (KVB)) to the DIVA vaccine commercialization process • Registration and patenting of the vaccine • Availabilty of extension services to promote uptake of the DIVA vaccine. • Farmer awareness about the availability and eeenefits of using the DIVA vaccine

Partners/stakeholders for scaling up their roles and stage of involvement	• KALRO - development, validation and application for registration of the CCPP DIVA vaccine • VMD – registration of vaccine • KEVEVAPI - production and marketing • Universities - research • County Veterinary Officers: Conduct vaccinations • DVS- regulator and disease control • County governments – creation of awareness about the the DIVA vaccine
C: Current situation and future scaling up	
Counties already promoted if any	Successful on-farm trials were undertaken in Kajiado and Taita Taveta counties.
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Inadequate vaccine distribution network • Inadequate vaccine access for individual farmers • Lack of marketing and distribution channels for the CCPP vaccine • The requirement for a cold chain during transportation and use of the vaccine
Suggestions for addressing the challenges	• Sensitization of farmers about the vaccine • Capacity building of farmers and service providers in the goat value chain • Aggregate farmers into groups for ease of access to the vaccine • Collaboration with county government in the supply of the vaccine • Create regional vaccine distribution channels • Lobby authorities to facilitate electricity connectivity in rural areas
Lessons learned for up scaling if any	Working with partners (farmers, farmer groups, county governments, agrovets) with comparative advantage will ensure the success of vaccine distribution and uptake,
Social, environmental, policy and market conditions are necessary for development and up scaling	• Acceptability of the DIVA vaccine in control of CCPP in goats • Policy to guide the incorporation of the DIVA vaccine in CCPP control in Kenya and the region • Registration of the DIVA vaccine with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies for its use in Kenya and

	the region. • Availability of market for goats (local and export)
Basic costs of the TIMPs	The cost of CCPP DIVA Vaccine is KES 30 per dose per animal
Estimated returns when using the TIMP	Vaccination reduces mortality by upto 50% hence the value of animals saved from the ravages of CCPP
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Gender issues and concerns in development, dissemination adoption and scaling up	• Women have limited access to information and knowledge on CCPP DIVA Vaccine • Cultural factors may not allow women and youth to participatenin treatment of animals • Women have limited access to education, training and extension services. • Women have less access to credit to purchase the vaccine. • Women may not be involved in making decisions on livestock production and marketing at the household level
Gender-related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit to purchase then vaccine • Employment opportunities for youth males in exist in participation during vaccination exercises.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to CCPP DIVA Vaccine information and knowledge. • Cultural factors may not allow women and youth females to vaccinate the animals • VMGs may also have limited access to finances to buy the vaccine. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit and purchase the vaccine • Employment opportunities for VMG exist in participation during the vaccination exercise.
E: Case studies/profiles of success stories	

Success stories	Vaccination of goats in a large-scale farms (Gicheha/Ziwani farm farm in Taita-Taveta County) where outbreaks of the disease had caused huge losses due to high mortalities stopped the deaths. All goats vaccinated with the CCPP DIVA vaccine had 100% survival rate
F: Status of TIMP Readiness	Ready for up scaling
Application guidelines for users	CCPP DIVA vaccine user material guidelines
G: Contacts	
Contacts	The Institute Director, KALRO-BioRI, Muguga P.O Box 362-00902 Kikuyu Email: director.biori@kalro.org Tel: +254 730 707 501
Lead organization and scientists	KALRO-BioRI-Muguga: KALRO-BioRI-Kabete; Mr. Willis Adero Dr. Martin Mwirigi, KALRO-BioRI-Kabete: Dr. Harrison Lutta, KU: Dr. Purity Nguhiu, KEVEVAPI: Dr. Jones Mutua, , KALRO-BioRI: Dr. Stella Makokha
Partner organizations	Kenya Veterinary Vaccine Production Institute, Kenyatta University, Kajiado County and Taita Taveta County Governments

Gaps

1. Validation of CCPP Diva diagnostic assay for ease of evaluating success of eradication programmes alongside the government vision 2030
2. Training of farmers on the new vaccine delivery model that will help in averting the over reliance on national vaccination programmes
3. Sensitization of farmers and other stakeholders on DIVA vaccine policy guide for ease of vaccine uptake and utilization.
4. Conduct economic analysis to assess profitability of the CCPP DIVA vaccine especially on facilitating the ease identification of goats suitable for the export market

2.7.7 Protocol for Production of Contaminant-free Milk

2.7.7 TIMP name	**Protocol for Production of Contaminant-free Milk**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Increased public health concerns on marketing and consumption of contaminated milk and milk products that may affect general human health. • Contaminants in milk negatively affects nutrition of high risk groups including infants, expectant mothers, and young children, the elderly and immune-compromised

	individuals who consume high volumes of milk and milk products. • Milk rejections and spoilage due to presence of contaminants significantly affects dairy farm profits and household nutrition.
What is it? (TIMP description)	A set of principles and procedures employed to reduce contaminants in milk from production from dairy animals to the eventual handling after milking. Adherence to the protocol prevents the introduction of chemical, physical and microbial contaminants into the milk. Minimizing common contaminants broadly include the use of safe feeds, clean animals, maintaining hygienic animal handling environment, adherence to drug withdrawal periods for treated animals, use of appropriate milking and storage equipment, milkmaid hygiene, milk testing and processing.
Justification	Milk is consumed by all communities worldwide and is considered the most nutritious and wholesome food. In Kenya, 80% of the milk produced by small holder farmers is marketed informally thus by-passing the formal safety and quality checks. Milk is a good medium for growth of micro-organisms that may cause diseases such as tuberculosis, brucellosis, Aflatoxicosis, listeriosis, gastrointestinal disorders and poisoning in humans. It may also carry chemicals, heavy metals and physical contaminants such as hair. The protocol is cheap to implement and will ensure production of quality and contaminant-free milk for consumption and processing thereby improving household nutrition and increasing incomes from sale of processed milk and milk products.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Milk producers and particularly smallholder farmers, milk processors, agri-preneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services

Critical/essential factors for successful promotion	• Regular extension visits to smallholder farmers to advise on clean milk production, environment hygiene and proper feed rations • Enforcement of quality milk regulations and control of informal marketing of milk by Kenya Dairy Board • Training of extension service providers in relevant counties as well as lead farmers on milk handling and processing • Supply and use of food grade milk handling and storage containers
Partners/stakeholders for scaling up and their roles	• Extension service providers (public and private) – to advise and train on the different types of contaminants and how to reduce the risk of introduction into milk • Kenya Dairy Board - to ensure marketing of quality milk and milk products • Smallholder farmers – to keep healthy animals in clean environments and ensure production of milk free from contaminants. • Dairy cooperative societies – to guide farmers on milk to be delivered in milk collection points
C: Current situation and future scaling up	
Counties where already promoted if any	Nandi and Kisumu
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Weak extension services • Limited skills in milk processing • Inadequate extension publications
Suggestions for addressing the challenges	• Collaborate with partners with interest in provision of extension services • Sensitize county governments on public health risks arising from consumption of contaminated milk and milk products and the need to prioritize the health of milk producing animals • Training of smallholder farmers in feed ration formulation and storage • Training in flock management, milking, storage and delivery to consumers • Availing farmer user materials
Lessons learned in up scaling if any	Marketing of quality milk leads to improved household incomes and human nutrition

Social, environmental, policy and market conditions necessary for development and up scaling	• Social acceptability of practices in the protocol • Need for practices are environmentally friendly • Government regulations and policies support production of safe milk through extension. • Markets for good quality milk in all milk production zones
Basic costs of the TIMP	About KES 100 for printing/photocopying of document
Estimated returns when using the TIMP	Increased incomes and improved human health from sale and consumption of contaminant-free milk and milk products
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to agricultural information, technology and knowledge • Women have limited access to education, training and extension services. • Women have less access to resources such as credit, to implement the practice • Women may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Employment opportunities for youths exist in performing the task
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge. • VMGs may also have limited access to finances to buy the required inputs such as mycotoxin binders and disinfectants. • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit to implement the protocal • Employment opportunities for VMG exist in sale of hygienic milk for human consumption
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Kabiyet Dairy Cooperative (Nandi County) applied the protocol and significantly increased milk supplies from cooperative members
Application guidelines for users	https://www.kalro.org/guidelines-for-reducing-contaminants-in-raw-goat-milk/

F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Institute Director KALRO VSRI Muguga P.O Box 32 -00902 Kikuyu
Lead organization and scientists	Ndirangu P.N. Omwenga S.G., Olum M.O., Maichomo M.W., Wesonga H.O., (VSRI Muguga, P.O Box 32, Kikuyu); Kipronoh A.K.(KALRO-DRI Naivasha, P,O Box 25, Naivasha;, Mungube E.O. Mugambi J.M. and Kirigua V.O. (KALRO Hqts, P.O Box 57811, Nairobi)
Partner organizations	University of Nairobi, Directorate of Veterinary Services, Kenya Dairy Board

Gaps

1. Validate the protocol on-farm and on different animal species
2. Assess the ease with which the protocol is adopted amongst professionals and dairy farmers
3. Assess willingness of the dairy farmers to adopt and pay for the costs associated with use of the protocol

2.7.8 Protocol for Reducing Infertility in Dairy Animals

2.7.8 TIMP name	**Protocol for Reducing Infertility in Dairy Animals**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Reduced productivity due to high incidence of infertility which has proven to be very costly to the farmers and farming communities. • Economic losses associated with lost lactation time due to long kidding intervals. • Early culling which cause reduction in herd sizes because of poor health due to infections or nutritional deficiencies • Increased cases of repeat inseminations which causes wastage of resources • High risk of spread of zoonotic diseases like brucellosis thus posing public health risk to humans from consumption of infected milk such as in the case of brucellosis or contact with the animals in cases of neosporosis among other infections.
What is it? (TIMP description)	Set of practices used to reduce infertility in breeding goats thereby reducing kidding intervals This reduces losses

	incurred by farmers by being able to: i) identify animals with anatomical causes of infertility ii) manage animals with physiological infertility due to hormonal imbalance iii) manage nutritional causes of infertility through improved feeding iv) detect and manage heat v) utilize Artificial Insemination (AI) technology and fertility hormones as well as vi) minimize infertility caused by reproductive diseases/infections. These can be implemented at the farm level or with the assistance of animal health service providers.
Justification	The dairy sub-sector is dominated by smallholder farmers, who produce up to 80% of the total milk production. Despite the importance of the sub-sector, dairy farmers particularly the smallholders are still faced with many challenges, among them reproductive inefficiencies or infertility. Some farmers are resorting to natural mating which has various disadvantages, this is due to AI failures. Infertility leads to reproductive wastage, losses in milk production, increased kidding intervals and sometimes ill health in affected animals. Implementation of these interventions will improve fertility and milk yield therefore improving livelihoods. It will also reduce premature animal culling and increase the number of kids born.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Animal health service providers, Extension agents, Smallholder dairy farmers, dairy cooperatives, farmer groups, researchers, agri-preneurs
Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Regular extension visits to smallholder farmers to advice on reproduction and breeding • Hormonal treatment of flocks to improve fertility • Improved animal nutrition for successful conception • Prompt treatment and observation of animals with symptoms of reproductive diseases
Partners/stakeholders for scaling up and their roles	• KALRO – development and validation of TIMPs • Extension service providers (public and private) –

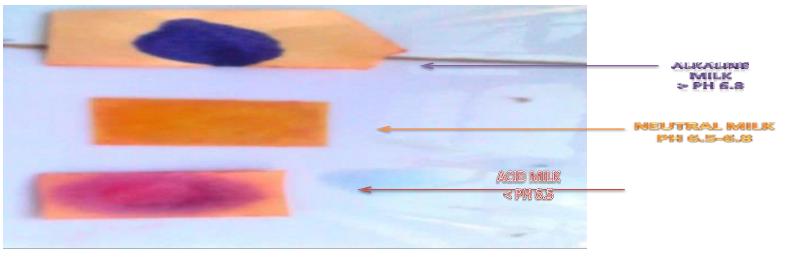
	farmer training • Smallholder farmers – end users • Dairy cooperatives – mobilization of farmers and farmer groups
C: Current situation and future scaling up	
Counties where already promoted if any	Kakamega, Nandi and Makueni
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Risks involved in fertility hormone use such as abortions. • Unavailability of sufficient fodder for dairy goat • Lack of skills in heat detection • Weak extension services and lack of skills in fertility hormone use
Suggestions for addressing the challenges	• Train service providers on the use of fertility hormones and estrus synchronization • Train on fodder cultivation and storage - linkage with other TIMPs • Train farmers on heat detection and AI
Lessons learned in upscaling if any	• There is need to train farmers on fertility management and the importance of nutrition on fertility.
Social, environmental, policy and market conditions necessary for development and upscaling	• Regulations to control the provision of services and use of fertility hormones by service providers • Policy framework to support AI services including provision of subsidies • Market for milk and milk products
Basic costs of the TIMP	• Cost of printimg/photocopyinmg guidelines which is approximately KES 100
Estimated returns when using the TIMP	• Benefits from milk per lactation • Value of kids born • Value of a doe retained in flock • Savings by avoiding repeat inseminations
• D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to resources such as land for production of fodder for feeding animals to enhance fertility • Women hve limited access to credit for payment for AI or fertility hormones for fertility interventions • Women may not be involved in making decisions on

	livestock management at household leve
Gender related opportunities	• Increased milk production hence improved household nutrition, increased income, increased involvement of women and youth in milk marketing • Involvement of women and youth as service providers in fertility related services
VMG issues and concerns in development, dissemination adoption and scaling up	• Due to their social status VMGs are often excluded from decision making during dissemination of technologies • VMGs face barriers in accessing information about AI and fertility managent in goats • VMGs face barriers in accessing resources such as credit to support AI activities in their farms
VMG related opportunities	Increased milk production hence improved nutrition and increased income, increased involvement of VMGs in milk marketing, need to train them on value addition and agri-business skills
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Kakamega and Nandi County governments and farmers have had experience with fertility clinics
Application guidelines for users	Guidelines to reduce infertility in small holder dairy goat
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Institute Director KALRO VSRI Muguga P.O Box 32 -00902 Kikuyu
Lead organization and scientists	KALRO VSRI - Moses Olum, Monicah Maichomo, Peter Mwangi and Erick Mungube, KALRO Headquarters
Partner organizations	University of Nairobi, Directorate of Veterinary Services, Various County Governments

Gaps

1. Validate the protocol on-farm and on different animal species
2. Assess the easy with which the protocol is adopted amongst professionals and dairy farmers
3. Assess willingness of the dairy farmers to adopt and pay for the costs associated with the TIMP

3.7.9 pH-based Mastitis Kit

3.7.9 TIMP name	pH-based Mastitis Kit
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low milk production in the dairy sector from undetected prolonged mastitis infection
What is it? (TIMP description)	This is a paper strip impregnated with pH indicators. The strip is orange in color and when dipped in milk, the colour changes depending on the state (acidity and alkalinity) of milk. There is no colour change when dipped in normal milk (pH of range 6.5 - 6.8. In mastitic milk which is slightly alkaline (pH of > 6.8), the strip changes from orange to blue while in fermented milk which slightly acidic (< 6.5), the strip changes from orange to pink.  pH-based Mastitis Kit Source: KALRO
Justification	Occurrence of mastitis in lactating animals reduces milk yield, changes milk composition and shortens the productive life of affected animals and as such requires rapid detection and treatment. However, this cannot be achieved with the current detection methods such as California Mastitis Test (CMT), somatic cell counts and culture which are highly technical, require trained personnel and laboratory facilities. This makes the diagnosis of mastitis expensive for smallholder dairy farmers. The use of the pH- based mastitis kit ensures rapid detection and treatment of the disease; The use of the kit will enhance productivity as well contribute to food safety as milk from mastitis animals will be discarded at milking.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cattle and camel keepers, County veterinary and livestock staff, private veterinary professionals, researchers, extension service providers, agripreneurs

Approaches to be used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Availability of reagents for kit production • Registration and patenting • Acceptability of the kit in mastitis detection • Simple for use by animal health service providers
Partners/stakeholders for scaling up and their roles	• Farmers - end users • Dairy cooperatives- promotion and dissemination of information • County Governments- extension services • KALRO, - research • Universities - training • VMD – registration of the strip
C: Current situation and future scaling up	
Counties where already promoted if any	Nakuru, Kajiado and Laikipia
Counties where TIMP will be up scaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Long registration process with VMD which has delayed commercialization efforts • Patent process for the kit is long and tedious • Kit still requires proper packaging • Limited awareness about the kit
Recommendations for addressing the challenges	• Consult VMD personnel when filling the registration dossier to hasten the process • Involve the KALRO legal team to engage with KIPI to fast- track patenting process • Fast track kit packaging • Develop user information and guidelines on how it works

Lessons learned in up scaling if any	• With a little training, farmers are able to conduct mastitis screening and make interpretation of the results accurately • The kit is rapid, farmer friendly and cost-effective • Farmers are willing to adopt the technology • With proper training the kit can be produced with ease in any diagnostic laboratory • The kit needs to be stored in a dry and cool place away from direct sunlight • Holding of the kit with hands is likely to causes changes on the kit which may interfere with its diagnostic accuracy
Social, environmental, policy and market conditions necessary	• Acceptability of the use of the strip in mastitis diagnosis in all dairy production systems • Guide on proper and hygienic disposal of the used kit to minimize environmental contamination • Policy guidelines to regulate manufacture, quality and use of the strip • Need to incorporate use of kit in milk marketing
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 100 per strip package of 10
Estimated returns	Udders free of mastitis produce 40% more milk than mastitis affected udders.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to mastitis kit information and knowledge. • Women have limited access to education, training and extension services. • Women have less access to credit to purchase the mastitis kit. • Cultural practices may limit women participation in vaccinating the animals • Women may not be involved in making decisions on livestock production and marketing at the household level
Gender related opportunities	• Affirmative action opportunities exist for women and youths to acquire the required credit • Employment opportunities for women and youth exist in in marketing hygienic and quality milk and milk products

VMG issues and concerns in dissemination, adoption and scaling up	• VMGs have less access to mastitis kit information and knowledge. • VMGs may also have limited access to finances to buy the mastitis kit • VMGs have limited access to education, training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by the VMGs due to lack of awareness
VMG related opportunities	• Affirmative action opportunities exist for VMGs to acquire the required credit for purchase of milk • Employment opportunities for VMG exist in marketing hygienic and quality milk and milk products
E: Case studies/profiles of success stories Success stories	During field validation of the kit on Cattle in Kajiado and on camels in Laikipia, livestock keepers appreciated the simplicity with which mastitis diagnosis can be done at herd level without a need for laboratory and trained staff
E: Case studies/profiles of success stories	
Application guidelines for users	Mastitis kit user information booklet available on KALRO website
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director KALRO VSRI, Muguga P.O. Box 32 - 00902 KIKUYU, Kenya
Lead organization and scientists	KALRO VSRI Muguga- Dr Ndirangu P.N., KALRO DRI Naivasha Dr. Kipronoh K.A., KALRO HQts Dr. Mungube E.O.
Partner organizations	Veterinary Medicines Directorate (VMD), Masinde Muliro University of Science and Technology (MMUST)-Kakamega, Kibabii University - Bungoma, County governments and DVS

Gaps

1. Validation of pH-based mastitis kit for detection and control of sub clinical mastitis dairy goats

2. Determine the cost-benefit of using the test in the control of sub-clinical mastitis in dairy animals
3. Develop guidelines for successful use of the test
4. Assess development, adoption and scaling up of the technology with gender and VMGs in consideration

2.8 Dairy Goat Commercialization, Marketing and Policy Options

2.8.1 Dairy Goat Commercialization

2.8.1 TIMP name	**Dairy Goat Commercialization**
Category (i.e. technology, innovation or management practice)	**Management practice**
A: Description of the technology, innovation or management practice	
Problem addressed	• Low incomes due inadequate commercialization of smallholder dairy goat farming • Low usage of essential agribusiness tools by small-holder dairy goat farmers particularly cost analysis, affecting their profitability • Lack of fundamental business planning and financial skills required for effective management and growth within the dairy goat sector.
What is it? (TIMP description)	Dairy commercialization is a practice which is intended to offer comprehensive support to dairy farmers with a decision-making tool using evidence-based, data-driven statistical analysis. By harnessing the power of business knowledge and conducting in-depth enterprise performance computations, this practice equips farmers with the means to effectively evaluate the financial health of their dairy enterprises. This includes the ability to discern whether their operations are operating at a profit or incurring losses, a crucial aspect that can vary under different production systems. Moreover, this management practice serves as a valuable transition tool for farmers, facilitating their shift from subsistence-level dairy production to a more commercial and sustainable approach. Through a wealth of information, strategic guidance, and data-driven decision-making, farmers can elevate their dairy enterprises to a commercial level, thereby improving their economic prospects and ensuring long-term viability in the dairy industry. The tool can be used for all dairy farm products including milk, milk products, hay, forages and manure among others.

Justification	The TIMP is dedicated to empowering these farmers with the knowledge and tools necessary to overcome these challenges, ultimately enabling them to make more informed, profitable, and sustainable decisions within the dynamic landscape of the dairy industry. The rationale for developing this management practice is rooted in the prevailing challenges faced by dairy goat farmers in trying to transit from subsistence to commercial farming. Currently, many dairy goat farmers are on subsistence production practices, with limited attention to crucial aspects like costing and gross margin analysis of the different dairy products. These elements are not only pivotal in determining the profitability of their dairy goat enterprises but also serve as vital indicators of the overall performance status of their ventures. Furthermore, there is inadequate record-keeping among dairy goat farmers which affects profitability analysis due to lack of credible data. This deficiency often forces farmers to rely on memory-based data recall, which, in turn, can yield inaccurate results and lead to misguided agribusiness advisories. Thus, the development of this management practice is essential to bridge these Gaps, empowering dairy goat farmers with the tools and knowledge needed to transition from subsistence farming to a more profitable, sustainable, and informed approach to dairy goat production.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy goat farmers , extension agents, service providers, researchers, agri-preneurs
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Farmers' understanding dairy goat business aspects and simple cost computations. Farmers should have a profound understanding of the various aspects of dairy business operations, including the ability to conduct straightforward cost and revenue computations. This

	knowledge is foundational for sound financial decision-making. • Understanding the importance of business planning and development • Presence of friendly regulations, legislation and policies in the Dairy sector • Tailor made training programme taking care of issues of gender and education of the farmers
Partners/stakeholders for scaling up and their roles	• KALRO-technology development and fine tuning, ToT, backstopping and monitor implementation • Extension service providers (public and private)-to train farmers and give timely information on dairy commercialization, Business planning and entrepreneurship • Farmer groups-adoption and utilization of technologies, innovations, management practices and related information • Kenya Bureau of Standards (KEBs)-Quality assurance and standardization
C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri/Meru/Nyanza/Tharakanithi
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Diverse Literacy Levels: Dairy goat farmers often exhibit varying literacy levels, which can hinder effective communication and comprehension of training materials. This TIMP requires basic analytical and computational skills for effective delivery. • Subsistence Mindset: Shifting farmers' focus from subsistence production to viewing dairy goat as a business can be a significant hurdle. • Resistance to Change: Some farmers may resist adopting new technologies and practices, as they may be comfortable with traditional methods.
Recommendations for addressing the challenges	• Capacity building of trainer (lead farmer) who will train farmers on commercializing their dairy goat enterprises with a focus on cost benefit analysis, Farm economic analysis, dairy goat entrepreneurship among others • Comprehensive training and support to enhance

	financial and data analysis capabilities. • Encouraging farmers to embrace commercialization means altering their mindset, emphasizing profit generation, and instilling business-oriented practices. • Tailored approaches and materials are necessary to accommodate these differences and ensure that all farmers, regardless of their literacy level, can participate in the training successfully. • Basic computer training • Availability of computers and other IT equipment including smart phones • Engage locals as trainers so as to use vernacular language where need be.
Lessons learned	The dairy goat commercialization management practice significantly strengthens the profitability, competitiveness, and long-term sustainability of dairy goat businesses. This practice equips farmers with the essential skills and knowledge needed for successful commercialization, reinforcing its position as a cornerstone in elevating both their income and overall economic returns, with a specific emphasis on household-level improvements. It serves as a beacon of transformation, empowering farmers to make the crucial transition from subsistence to commercial farming, ultimately fostering financial stability and playing a pivotal role in advancing the prosperity of farming communities
Social, environmental, policy and market conditions necessary	• Social acceptance of dairy goat products to propel the commercialization of dairy goat farming by creating a reliable and expanding market for farmers' produce. Moreover, social acceptance can foster trust and positive perceptions of the quality and safety of dairy goat products, further stimulating their commercial success • There should be a business environment with friendly regulations and legislation that supports dairy goat commercialization and offers incentives to participating farmers. • Access to markets and streamlining trade policies to ensure favorable conditions for dairy products. • Expanding and diversifying dairy markets to accommodate increased production and create demand for dairy goat products. • Sustainable practices which promote environmentally sustainable dairy goat farming practices such as waste management
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	Approximately KES 100 for data connectivity to use the relevant analytical tools. The associated charges are based on individual service providers.
Estimated returns	It is expected that farmers utilizing this information will experience increased yields and improved incomes from their dairy goat enterprises.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Gender disparities in access to resources such as land, credit, and technology can hinder women's active participation in dairy goat commercialization. • Women often bear the brunt of domestic and caregiving responsibilities. The adoption of dairy goat commercialization may increase their workload, requiring solutions to balance responsibilities effectively. • In some farming communities, women may have limited decision-making power. Inclusivity in decision-making related to dairy goat commercialization is essential to ensure their voices are heard. • Tailored training programs that consider women's literacy levels and learning preferences are crucial to provide equal opportunities for both genders to acquire the necessary skills. • Ensuring that women have equal access to markets and opportunities to sell their dairy goat products is important. • Outreach programs should reach both men and women farmers with relevant information and support services.
Gender related opportunities	• Youths, women and men can carry out business analytical services as a paid undertaking • Economic Empowerment through dairy goat commercialization can lead to increased income and financial independence, allowing more control over household resources and decision-making especially for women. • Women often play a central role in processing and value addition activities related to dairy products. This can create opportunities for them to develop and market value-added dairy goat products. • Skills development through the training and capacity-building programs tailored for women in the dairy sector can enhance their skills and knowledge, enabling them to actively engage in dairy goat commercialization.

	• Dairy goat commercialization offers women the opportunity to become entrepreneurs by managing their own dairy goat enterprises, thereby contributing to economic growth.
VMG issues and concerns in development, dissemination adoption and scaling up	• VMGs often have restricted access to essential resources like land, capital, and technology, which hinders their participation in commercial dairy goat farming. • VMGs are more susceptible to economic shocks and disruptions, which can affect their ability to invest in and sustain commercial dairy goat enterprises. • VMGs may have limited access to training and capacity-building opportunities, leaving them with inadequate knowledge and skills for dairy goat commercialization. • VMGs may encounter difficulties in accessing markets, finding buyers, and selling their dairy goat products, limiting their ability to benefit from commercialization. • Discrimination and social norms can restrict VMGs' opportunities and influence their roles and decision-making within dairy goat enterprises. • Inadequate infrastructure and technology in marginalized areas can hinder the adoption of modern dairy goat farming practices. • Training programs not accommodating materials in accessible formats e.g. sign language interpreters, and physical facilities that are wheelchair-friendly
VMG related opportunities	• Training opportunities for VMGs to effectively carry out dairy goat enterprise business analysis • VMGs can increase their income through dairy goat commercialization, creating a reliable source of revenue for their households • Engaging in dairy goat commercialization can lead to greater economic independence, reducing dependence on external support and enhancing their financial well-being • VMGs can benefit from improved access to dairy goat products, enhancing the nutritional quality of their diets and contributing to household food security • VMGs can explore entrepreneurial opportunities within the dairy value chain, such as dairy goat processing, value-added product development, or even establishing small-scale dairy goat businesses • VMGs can benefit from broader market access,

	enabling them to sell their dairy goat products more effectively and generate higher income • Active involvement in dairy goat commercialization can help integrate VMGs into their local communities and empower them to participate in community decision-making
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Per unit cost calculation tool software available at https://www.thescanfoundation.org
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Institute Director, KALRO Dairy Research Institute/Naivasha P.O Box 25-20117 Naivasha director.dri@kalro.org
Lead organization and scientists	KALRO N. Mathai, A. Murage, , E. Chelimo, B. Wachira, N. Kanegeni, E Nyambati
Partner organizations	Ministry of Agriculture Livestock and Fisheries, Kenya

2.8.2 Dairy Goat Marketing

2.8.2 TIMP name	**Dairy Goat Marketing**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	• Poorly coordinated dairy goat milk marketing channels • Insufficient information on markets for milk, by products and inputs for goat production • Inadequate knowledge on market dynamics and their effect on prices
What is it? (TIMP description)	The TIMP is designed to equip farmers with essential information, skills, and knowledge to excel in the competitive dairy goat market. Farmers will gain a deep understanding of efficient markets, market dynamics, and key linkages within the dairy value chain. They will also explore consumer preferences and delve into the economics

	of product pricing. By perfecting the skills needed to connect farmers with various market opportunities, this practice aims to maximize dairy goat output and sales, ultimately promoting a thriving and prosperous dairy business, transiting from subsistence to commercial venture.
Justification	In order to successfully transition from subsistence to commercial dairy goat farming, farmers must possess essential business planning skills, a critical prerequisite for effective enterprise management and maximizing earnings. Additionally, a pressing need exists for enhancing their skills in marketing dairy products, while understanding the complexity of market price determination and dynamics. Often, dairy farmers grapple with persistently low prices for their goat milk and dairy goat products, dissuading them from fully realizing the potential of dairy goat farming. Disorganized milk markets further compound this issue, disrupting the seamless flow of dairy goat products from the farmer. To address these challenges, it is crucial to bridge the business planning gap and equip farmers with the tools and knowledge to diversify their dairy goat enterprises strategically, targeting specific niche markets. By doing so, we empower dairy goat farmers to not only thrive but to unlock the full potential of the dairy value chain, ultimately enhancing their financial resilience and promoting a more prosperous dairy sector.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Smallholder dairy goat farmers and stakeholders in the dairy value chain, agri-preneurs
Approaches used in dissemination	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	• Enabling regulatory framework i.e legislation, and policies that support and facilitate dairy goat marketing efforts • Inclusive value chain integration incorporating all stakeholders along the dairy value chain

	• Designing tailored training programs to the specific needs, knowledge levels, and constraints of the target dairy goat farmers, ensuring the content is relevant and accessible • Facilitators who are knowledgeable in dairy goat marketing and possess effective training and communication skills • Provision dairy goat farmers with access to essential resources, including market information, market linkages, and financial support to kick start their marketing efforts • Incorporation of practical exercises, demonstrations, and real-life case studies to enhance farmers' understanding of marketing concepts and strategies • Farmer networks and cooperatives to collectively access markets and negotiate better prices. • Collaborate with agricultural and dairy goat associations, NGOs, and extension services to strengthen the marketing capacities of dairy goat farmers
Partners/stakeholders for scaling up and their roles	• KALRO - technology development and fine tuning, ToT, backstopping and monitor implementation • Extension service providers (public and private) - to train dairy goat farmers and give timely information on markets and market information • Farmer groups - adoption and utilization of Technologies, Innovations, management practices and related information.
C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri/Meru/Nyanza/Tharakanithi
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Varying education levels of the farmers, and some may have limited formal education, making it essential to tailor training materials to diverse learning needs. • Dairy goat farmers may experience low motivation due to historically poor market prices, necessitating efforts to boost their confidence and enthusiasm for engaging in dairy goat marketing

	• Limited access to markets, insufficient market information, and a lack of marketing skills among farmers can impede their ability to make informed marketing decisions • Middlemen and other actors along the dairy value chain can exert significant influence, potentially limiting dairy goat farmers' independence and returns. • Dairy goat farmers may lack comprehensive knowledge of the ever-evolving dynamics of dairy product marketing • The seasonality of dairy products often leads to price fluctuations, impacting the stability of farmers' income and market opportunities. • Insufficient knowledge on post-harvest handling and storage for dairy goat products • Existing policy regulations in the Dairy industry and whether they are favourable to dairy goat producers
Recommendations for addressing the challenges	• Provision of comprehensive training to equip farmers with the marketing skills needed such as market analysis, pricing strategies, and customer relationship management • Inclusivity and coordination of all dairy value chain actors, including dairy goat farmers, processors, and intermediaries, to ensure seamless market operations and promote collaboration • Capacity building of dairy goat farmers with a specific focus on markets and market informatio • Formation of dairy goat farmers groups to enhance their bargaining power in the market. • Capacity building of dairy goat chain actors to enhance market efficiency and fairness • Tailoring training materials to suit dairy goat farmers with varying levels of education
Lessons learned	• Tailored marketing strategies are important as “one-size-fits-all” marketing strategies may not work for all farmers. • A comprehensive market information system is important to provide dairy goat farmers with up-to-date data on prevailing market conditions, including demand trends, pricing fluctuations, and consumer preferences. • Real-time price indices enable dairy goat farmers to make informed decisions about when and where to sell their dairy goat products, ultimately maximizing their returns.

	• Continuous market research is crucial to understand the evolving preferences of consumers and the dynamics of the dairy goat market helps in adapting marketing strategies. • Encouraging dairy goat farmers to move beyond raw milk production by adding value to dairy goat products which can significantly increase the profitability of their dairy goat businesses • Emphasizing the importance of maintaining high-quality standards in dairy goat production is essential for accessing premium markets and building consumer trust. • Cooperative model can help small-scale dairy goat farmers access better markets and negotiate better prices. • Strong market linkages can ensure a smooth flow of products from the farm to the market, reducing post-harvest losses and ensuring timely deliveries • Digital platforms can help dairy goat farmers stay informed about market trends, connect with buyers, and manage their businesses more efficiently
Social, environmental, policy and market conditions necessary	• Conducive policy and regulatory framework for competitive markets • Farmers' ability to produce and market the surplus dairy goat farm produce • Assess the farmers' existing knowledge of dairy goat marketing and their level of education. • Consider cultural norms and social structures that may influence marketing practices • Dairy goat farmers' access to training resources, such as training materials, instructors, and facilities. • Gender equity in training programs • Favourable climate and geographic location, as they can affect the seasonality of dairy goat milk production and the availability of resources for dairy goat farming. • Availability of infrastructure such as roads, transportation, and electricity, which can impact the logistics of marketing dairy goat products • Environmentally sustainable farming practices, as these can affect not only the environment but also consumers' perception of the products • Policy and regulatory framework that supports dairy goat marketing practices • Farmers' awareness of and compliance with relevant policies, regulations and standards related to food

	safety, labeling, and quality • An existing market demand for dairy goat products and consumer preferences
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Dairy goat marketing information will be available for free from the identified lead farmer in their locality
Estimated returns	It is expected that dairy goat farmers utilizing this information will experience increased market access and participation resulting in sustainable and economically viable dairy goat enterprises.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Youth are more engaged in collection and transportation of milk almost exclusively reserved for male youth • Employment at Milk Collection Centres (MCCs) is also male-dominated, especially in management and field-related operations • Gender disparities in access and ownership of resources that may affects participation in the enterprise • Skewed access to training and extension services, which can lead to a knowledge gap in modern dairy goat marketing practices • Traditional gender roles may limit women's participation in decision-making regarding dairy goat marketing and business development • Limited control over the income generated from dairy goat farming, which can hinder ability to invest in marketing efforts • Women often juggle multiple responsibilities, including household chores and caregiving, in addition to dairy goat farming • Gender-based barriers may prevent women from entering certain markets or engaging in negotiations with buyers • Cultural norms in some regions may restrict women from engaging in public or entrepreneurial activities, including dairy goat marketing
Gender related opportunities	• Youth involvement dairy industry activities such as milk transportation make them well-suited to this demanding aspect of the supply chain, ensuring that fresh milk reaches its intended destinations efficiently • Women play a central role in the retail sector of the dairy goat market as entrepreneurs and retailers • Men take on significant responsibilities in the management and administration of collection and

	processing centers • Economic independence, contributing to poverty reduction and overall household income growth. • Inclusive decision-making processes
VMG issues and concerns in development, dissemination adoption and scaling up	• Organizing VMGs for collective marketing of dairy goat products • VMG may have limited access to land and livestock, which are fundamental resources for dairy farming and marketing • Lower literacy rates among VMG can pose challenges in accessing and understanding training materials and market information • Language disparities may create difficulties in disseminating information and training materials • VMG may face discrimination when attempting to access markets or negotiate prices for their dairy goat products • Some VMG may reside in remote or isolated areas, making it challenging to reach markets and access transportation infrastructure.
VMG related opportunities	• Tailoring marketing development programs to the specific needs of VMG, offering customized training and resources. • Implementing policies and practices that combat discrimination based on gender, caste, ethnicity, or other factors. • Fostering the economic and social empowerment of VMG through capacity-building, education, and awareness campaigns. • Ensuring that VMG are adequately represented and have a voice in dairy goat marketing organizations and cooperatives. • Creating value chains that incorporate VMG at multiple stages, from production to processing and marketing.
E: Case studies/profiles of success stories	
Success stories	Various dairy goat associations in different regions in Kenya
Application guidelines for users	Smart Marketing Manual (USAID)
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	

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Partner organizations	Ministry of Agriculture Livestock and Fisheries, Kenya

2.8.3 Dairy Goat Policy Options and Regulations

2.8.3 TIMP name	**Dairy Goat Policy Options and Regulations**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Inadequate awareness of the policies and regulations in the dairy sector, including critical aspects related to production, by small holder dairy goat farmers which limits dairy goat farmers' ability to comply and take full advantage of opportunities for sustainable and profitable farming
What is it? (TIMP description)	Dairy Goat Policy Options and Regulations is an essential tool in farm management as it provides dairy goat farmers with structured framework for operating legally, improving product quality, gaining market access, adopting sustainable practices, and advocating for their needs. By adhering to regulations and staying informed about relevant policies, dairy goat `farmers can enhance their economic prospects and contribute to the overall sustainability and success of the agricultural sector
Justification	Training farmers on policies and regulations in the dairy sector is paramount as it addresses a significant knowledge gap that hinders farmers from understanding and complying with critical legal requirements. This lack of awareness can lead to unintended violations, penalties, and legal challenges. Moreover, compliance with stringent standards for dairy products' quality, hygiene, and safety is essential to safeguard consumers' health and enhance the reputation of dairy products. Access to local and international markets is often contingent on adherence to specific regulations, and without proper knowledge, farmers may miss out on

	lucrative market opportunities, limiting their income potential. Additionally, understanding and adhering to environmental regulations is crucial for the long-term sustainability of dairy farming practices. Government policies frequently offer financial incentives and support programs for smallholder dairy farmers, and training is essential to help them access these opportunities, reduce production costs, and increase profitability. Knowledge of policies also empowers farmers to participate in shaping agricultural policies that benefit their sector, fosters innovation and responsible practices, and ultimately contributes to economic empowerment and the overall success of smallholder farmers and the dairy industry
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmer Field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Demonstrations - On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings • Public and private Extension Agents • Farmer to farmer extension models • Mass media – Electronic and print • Publications-posters/brochures/leaflets, manuals • Digital Platforms-Website, Dashboards, Apps, social media short message services
Approaches used in dissemination	Presentations and group discussions
Critical/essential factors for successful promotion	• Relevant training programs tailored to the specific needs and challenges faced by smallholder dairy goat farmers • Accessibility of training materials and sessions should be easily accessible to smallholder dairy goat farmers, including those in rural or remote areas • Training content should be presented in a clear and understandable manner, avoiding overly technical or legal jargon • A ctive engagement of farmers actively through participatory learning methods, group discussions, case studies, and practical demonstrations to ensure better knowledge retention and application. • Inclusivity - consider the diverse needs of smallholder dairy farmers, including women and youth, and design training programs that are inclusive and equitable

Partners/stakeholders for scaling up and their roles	• KALRO - technology development and fine tuning, ToT, backstopping and monitor implementation • Extension service providers (public and private) – training of dairy goat farmers and give timely information on current policies and regulations governing the dairy industry. • Farmer groups -adoption and utilization of Technologies, Innovations, management practices and related information.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be upscaled	All value chain counties including Kilifi, Meru, Bomet, Bungoma, Busia, Embu, Homa Bay, Taita Taveta, Kajiado, Kakamega, Kericho, Kiambu, Nyeri, Kirinyaga, Migori, Kisii, Muranga, Kisumu, Nakuru, Nandi, Narok, Machakos, Uasin Gishu, Nyamira, Makueni, Nyandarua, Vihiga, Tharaka Nithi.
Challenges in dissemination	• Complexity of legal language - policies and regulations are often written in complex legal language that can be difficult for farmers to understand, leading to confusion and misinterpretation. • Diversity of the audiences -dairy goat farmers come from diverse backgrounds, and one-size-fits-all training may not address the specific needs of different groups • Awareness gaps - dairy goat farmers may lack awareness regarding the existence or relevance of specific policies and regulations
Recommendations for addressing the challenges	• Translation of complex legal language into simple, farmer-friendly terms. Where possible, use local languages when necessary to ensure that policy documents are accessible and comprehensibly • Tailoring training programs to the specific needs and literacy levels of different farmer groups. Address the unique requirements of women, youth, and marginalized communities • Illustration of policy concepts with practical, real-world examples that resonate with farmers and demonstrate the impact of compliance on their daily practices
Lessons learned	• Effective training in dairy policies and regulations is fundamental in empowering farmers with the knowledge and tools needed to navigate the dynamic

	agricultural landscape, adhere to legal requirements, and make informed decisions that support the long-term success and economic well-being of their dairy goat enterprises.
Social, environmental, policy and market conditions necessary	• Need for farmers' awareness on the importance of compliance to policies and regulations • Have access to some level education and relevant resources • Access and support by farmer-friendly policies. • Rewarding markets on compliance and create opportunities for farmers to benefit from their adherence to regulations. • Culturally sensitive training program and engagement with the local community to foster trust and cooperation
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	This information will be available for free to farmers during trainings
Estimated returns	Farmers will be empowered to operate in a legal, competitive and conducive environment for dairy goat business where operations will be within set guidelines, laws and regulations.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Gender inequality in access of training opportunities and resources • Gender inequality in voicing during policy discussions • Differences in access to resources, decision-making power, and labor roles • Time constraints faced by women due to household and caregiving responsibilities, and adapting training schedules and formats accordingly • Cultural norms and beliefs may discourage women from participating in public activities or interacting with unfamiliar individuals, including trainers
Gender related opportunities	• Understanding policy options can lead to a deeper appreciation of the economic implications of regulatory compliance, potentially creating new business and career paths for men, women and youth as trainers. • This knowledge can also empower them to navigate the regulatory landscape effectively and seize economic opportunities within the context of policy and regulation.
VMG issues and concerns in development, dissemination	• VMG may have financial constraints, limited transportation, or physical accessibility issues.

adoption and scaling up	• VMGs especially women have unique needs and challenges, such as childcare and safety concerns. • VMG may hacve challenges in accessing training programs not accommodating materials in accessible formats e.g. sign language interpreters, and physical facilities that are wheelchair-friendly. • VMGs have economic constraints that can prevent them from attending training programs, as they may not be able to afford travel costs or no wages • Geographic isolation of VMG especially for rural and remote communities • Stigmatization and discrimination of VMG can deter individuals from participating in training programs • VMG may lack of community support
VMG related opportunities	• VMGs gain awareness and a deeper understanding of relevant policies and regulations, which can help them make informed decisions about their activities and rights • Training equips VMGs with the knowledge and skills needed to actively engage in policy advocacy, allowing them to voice their concerns and influence policy decisions that affect their well-being • Understanding and complying with regulations can protect VMGs from legal issues and ensure their activities align with the law, reducing the risk of penalties or discrimination • Compliance with regulations can open doors to markets and economic opportunities, enabling VMGs to sell products or services that meet legal requirements and access better income prospects • VMGs can identify dairy goat entrepreneurial opportunities in the compliance and regulatory space, offering services related to quality control, product certification, or compliance consulting
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Technical bulletins available
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
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