



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



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TECHNOLOGIES, INNOVATIONS AND MANAGEMENT PRACTICES
FOR SWEETPOTATO VALUE CHAIN**

Kenya Agricultural and Livestock Research Organization

**NATIONAL AGRICULTURAL AND RURAL INCLUSIVE GROWTH PROJECT
(NARIGP)**

October 2021

DISCLAIMER

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

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FOREWORD

The National Agricultural Rural and Inclusive Growth Project (NARIGP) tasked the Kenya Agricultural and Livestock Research Organization (KALRO) to develop and deliver context specific Climate Smart Agriculture (CSA) Technologies, Innovation and Management Practices (TIMPs). This document provides a detailed inventory of TIMPs that have been developed in sweetpotato value chain.

Extensive information from research and background data has been reviewed to help in development of this TIMPs inventory. To disseminate the TIMPs, a Training of Trainers (ToT) manual has been developed. The design of the manual takes into consideration the delivery system, partners and their roles, duration of training and logical flow of the modules. The training modules have uniform outline that ensures all aspects of the TIMPs are fully covered in a way that the trainees can absorb and relate to. Various delivery methods are deployed and where possible demonstrations and practical work are incorporated to enable the trainees learn by participating in the actual field activities. This TIMPs inventory is therefore to be used in conjunction with the respective sweetpotato ToT Manual. The uptake of these TIMPs is expected to contribute to increased productivity and profitability for improved incomes.

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

Eliud K. Kireger, PhD, OGW

Director General, KALRO

PREFACE

The National Agricultural and Rural Inclusive Growth Project (NARIGP) is funded by the Government of Kenya and the World Bank. This Project is being implemented in 21 Counties in the country at an approximate cost of KES 22 billion and will run for five (5) years. The Project development objective is *“To increase agricultural productivity and profitability of targeted rural communities in selected Counties, and in the event of an Eligible Crisis or Emergency, to provide immediate and effective response.”* To achieve the objective, the Project is promoting adoption of climate smart agricultural technologies, innovations and management practices (TIMPs) that maximize productivity, increase profitability and enhance commercialisation

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

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

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

The National Project Coordination Unit is grateful to all who participated in the development and production of this TIMPs inventory for the sweetpotato value chain. I hope that this inventory will be adopted and optimally used by the Counties.

John Kimani

National Project Coordinator

National Agricultural and Rural Inclusive Growth Project

ABBREVIATIONS AND ACRONYMS

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

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

1.1 Definition of terms

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

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

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

1.2 Summary of Inventory of TIMPs in the sweetpotato value chain

The inventory process identified **132** TIMPs comprising **59** technologies, **18** innovations and **55** management practices, distributed among the sub-themes, as indicated in Table 1.

Table 1 Summary of sweetpotato TIMPs

Commodity value chain	Sub-theme	Technologies	Innovations	Management practices
Sweetpotato	Improved sweetpotato varieties	19	0	0
Sweetpotato	Sweetpotato seed system	3	0	0
Sweetpotato	GAPs and Food Safety	0	0	2
Sweetpotato	Agronomic Management Practices	0	0	8
Sweetpotato	Soil Fertility Management	1	1	3
Sweetpotato	Soil and Water Management	11	0	4
Sweetpotato	Sweetpotato Crop Health	10	5	20
Sweetpotato	Postharvest Management	6	0	2
Sweetpotato	Sweetpotato Value Addition	1	11	0
Sweetpotato	Mechanization of sweetpotato production activities	8	1	2
Sweetpotato	Sweetpotato Business and Marketing	0	0	8
Sweetpotato	Agricultural policy	0	0	5
Total		59	18	55

1.3 Summary of status of TIMPs in sweetpotato value chain

The inventory process resulted in a total of **77** TIMPs that are ready for upscaling, **42** TIMPs that require validation and **13** TIMPs that require further research in the sub-themes, as indicated in Table 2.

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

Commodity value chain	Sub-theme	Ready for upscaling	Require validation	Requires further research
Sweetpotato	Improved sweetpotato varieties	6	13	0
Sweetpotato	Sweetpotato seed system	3	0	0
Sweetpotato	GAPs and food safety	2	0	0
Sweetpotato	Agronomic management practices	9	0	0
Sweetpotato	Soil Fertility Management	3	2	0
Sweetpotato	Soil and Water Management	5	8	2
Sweetpotato	Sweetpotato Crop health	12	11	11
Sweetpotato	Postharvest management	5	3	0
Sweetpotato	Sweetpotato value addition	11	1	0
Sweetpotato	Mechanization of sweetpotato production activities	8	4	0
Sweetpotato	Sweetpotato business and marketing	8	0	0
Sweetpotato	Agricultural policy	5	0	0
Overall total		76	42	13

1.4 Inventory of sweetpotato TIMPs by category and status

Table 3 Inventory of sweetpotato TIMPs by category and status

TIMPs sub-theme	TIMPs title	TIMPs category	Status
2.1 Improved sweetpotato varieties	2.1.1 Kenspot (Nyawo)	Technology	Ready for upscaling
	2.1.2 Kenspot5	Technology	Ready for upscaling
	2.1.3 Kenspot4	Technology	Ready for upscaling
	2.1.4 SPK 004 (Kakamega)	Technology	Ready for upscaling
	2.1.5 Kenspot3	Technology	Ready for upscaling
	2.1.6 Kabode	Technology	Requires validation
	2.1.7 Vitaa	Technology	Requires validation
	2.1.8 Naspoti1	Technology	Ready for upscaling
	2.1.9 Irene	Technology	Requires validation
	2.1.10 Silklow6 (Kat SP1)	Technology	Requires validation
	2.1.11 Shock5 (Kat SP5)	Technology	Requires validation
	2.1.12 Mwavuli	Technology	Requires validation
	2.1.13 Mugande	Technology	Requires validation
	2.1.14 Kemb10	Technology	Requires validation
	2.1.15 Jankaroti	Technology	Requires validation
	2.1.16 Cuny (Kunyibwonjo)	Technology	Requires validation
	2.1.17 Namnyekera	Technology	Requires validation
	2.1.18 Kenspot2	Technology	Requires validation
	2.1.19 Variety Bungoma	Technology	Requires validation
2.2 Sweetpotato Seed System	2.2.1. Tissue culture plantlets	Technology	Ready for upscaling
	2.2.2. Rapid vine multiplication	Technology	Ready for upscaling
	2.2.3. Conventional vine multiplication in the field	Technology	Requires validation
2.3 Good Agricultural Practices and Food Safety Management Systems	2.3.1 Good Agricultural Practices (GAPs) for sweetpotato.	Management practice	Ready for upscaling
	2.3.2 Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) plan for sweetpotato value chain in Kenya	Management practice	Ready for upscaling
2.4 Agronomic Management Practices	2.4.1 Land preparation	Management practice	Ready for upscaling
	2.4.2 Sourcing and selection of vines	Management practice	Ready for upscaling
	2.4.3 Planting (a) Methods of planting	Innovation	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.4.4 Planting (a) Crop spacing	Management practice	Ready for upscaling
	2.4.5 Fertilizer/manure application	Management practice	Ready for upscaling
	2.4.6 Crop rotation for increased yields	Management practice	Ready for upscaling
	2.4.7 Weed control	Management practice	Ready for upscaling
	2.4.8 Intercropping	Management practice	Ready for upscaling
	2.4.10 Harvesting and postharvesting techniques	Management practice	Ready for upscaling
2.5 Soil Fertility Management	2.5.1 Integrated Manure Management	Management practice	Requires validation
	2.5.2 Diagnosing crop nutrient deficiency in sweetpotato	Management practice	Ready for upscaling
	2.5.3 Integrated Soil Fertility Management (ISFM)	Management practice	Requires validation
	2.5.4 Soil and plant tissue testing	Technology	Ready for upscaling
	2.5.5 Rapid soil testing services	Innovation	Requires validation
2.6 Soil and Water Management	2.6.1 Water testing for irrigation suitability	Technology	Requires validation
	2.6.2 Irrigation water sources and use	Technology	Requires validation
	2.6.3 Drip irrigation in sweetpotato production	Technology	Requires validation
	2.6.4 Zai pits	Technology	Ready for upscaling
	2.6.5 Bench terraces	Management practice	Ready for upscaling
	2.6.6. <i>Fanya juu</i> terraces	Technology	Requires validation
	2.6.7. Stone lines	Technology	Requires validation
	2.6.8 Retention ditches	Technology	Requires validation
	2.6.9 Grass strips	Technology	Requires validation
	2.6.10 Tied ridges /ridging /earthing	Technology	Requires validation
	2.6.11 Rain water harvesting systems (ponds and dams)	Management practice	Ready for upscaling
	2.6.12 Conservation Agriculture	Management practice	Ready for upscaling
	2.6.13 Sweetpotato-cereal intercropping	Management practice	Requires further research

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.6.14 Drip irrigation systems for small scale farmers	Technology	Ready for upscaling
2.7 Sweetpotato Crop Health	2.7.1 Scouting for timely identification and control of sweetpotato diseases	Management practice	Ready for upscaling
	2.7.2 Biological Control of Fusarium Wilt of sweetpotato with Cross-Protection by Prior Inoculation with Nonpathogenic <i>Fusarium oxysporum</i>	Technology	Requires validation
	2.7.3 Identification of disease-free areas for production of healthy sweetpotato seed	Management Practice	Requires validation
	2.7.4 Integrated Pest Management practices for sweetpotato mirids (sucking bugs).	Management practice	Ready for upscaling
	2.7.5 Management of sweetpotato weevils by use of Integrated Pest Management Practices.	Management practice	Ready for upscaling
	2.7.6 Control of aphids (<i>Aphis gossypii</i> , <i>Myzuz persicae</i> , <i>Aphis spiraecola</i> and <i>Aphis middletonii</i>) in Ssweetpotato by use of Integrated Pest Management Practices.	Management Practice	Ready for upscaling
	2.7.7 Soil steam sterilization for the management of black rot and Cercospora leaf spot diseases of sweetpotato.	Innovation	Requires validation
	2.7.8 Management of foliar diseases (Alternaria leaf spot and Cercospora leaf spot) of sweetpotato by use of integrated disease management practices.	Management practice	Ready for upscaling
	2.7.9 Scouting for timely identification and control of sweetpotato pests	Management practice	Ready for upscaling
	2.7.10 Sweetpotato-legume crop rotation program for the management of rhizoctonia stem canker and stem blight diseases of sweetpotato.	Management practice	Ready for upscaling
	2.7.11 Field sanitation as a means of controlling aphids in sweetpotato fields.	Management practice	Requires validation
	2.7.12 Sweetpotato field sanitation for the management of circular spot disease.	Management practice	Requires validation
	2.7.13 Use of plant extracts for control of sweetpotato butterfly.	Innovation	Requires further research
	2.7.14 Evaluation of pesticides for effectiveness in control of Clearwing moth in sweetpotato.	Technology	Requires further research
	2.7.15 Community rangeland rehabilitation to increase populations of natural enemies for pest management in sweetpotato.	Management practice,	Requires further research

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.7.16 Field sanitation as a means of controlling Alternaria leaf spot disease incidences	Management practice	Requires validation
	2.7.17 Anaerobic Soil Disinfection (ASD) for the management of soil borne pathogens of sweetpotato.	Technology	Requires validation
	2.7.18 Crop rotation as a means of controlling stem blight disease in sweetpotato.	Management practice	Requires validation
	2.7.19 Evaluation of fungicides for effectiveness in the control of blue mold, dry and end rots in sweetpotato.	Technology	Requires further research
	2.7.20 The use of resistant sweetpotato varieties in managing Sweetpotato Chlorotic Stunt (SPCSV), Sweetpotato Feathery Mottle Virus (SPFMV) and sweetpotato Latent Virus (SPLV) diseases.	Management practice	Requires further research
	2.7.21 The use of Biocontrol agents in managing whiteflies in sweetpotato	Technology	Requires further research
	2.7.22 Evaluation of pesticides for effectiveness in control of sweetpotato weevils.	Technology	Requires further research
	2.7.23 Quarantine and movement restriction for management of leaf spot diseases and mildews in sweetpotato.	Management practice	Ready for upscaling
	2.7.24 Safe use of pesticides	Management practice	Ready for upscaling
	2.7.25 Integrated Pest Management of root-knot and dagger nematodes in sweetpotato	Management practice	Ready for upscaling
	2.7.26 Intergrated weed management in sweetpotato	Innovation	Ready for upscaling
	2.7.27 Intercropping for weed management in sweetpotato	Innovation	Ready for upscaling
	2.7.28 Covercropping for weed management in sweetpotato	Technology	Ready for upscaling
	2.7.29 Mulching for weed management in sweetpotato	Technology	Ready for upscaling
	2.7.30 Use of herbicides for weed management in sweetpotato	Technology	Requires validation
	2.7.31 Solarization bed for management of weeds in sweetpotato	Technology	Requires validation
	2.7.32 Stale bed for weed management in sweetpotato	Technology	Requires further research

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.7.33 Mechanical weed management	Innovation	Ready for upscaling
	2.7.34 Crop rotation for weed management in sweetpotato	Management practice	Ready for upscaling
	2.7.35 Safe use of herbicides	Management practice	Requires further research
2.8 Harvest and postharvest management	2.8.1 Harvesting of sweetpotato	Management practice	Requires validation
	2.8.2 Sorting and grading of sweetpotato.	Management practice	Ready for upscaling
	2.8.3 Curing	Management practice	Ready for upscaling
	2.8.4 Zero Energy Brick Cooler	Technology	Ready for upscaling
	2.8.5 Evaporative Charcoal Cooler	Technology	Requires validation
	2.8.6 Clamp storage	Technology	Requires validation
	2.8.7 Pit storage	Technology	Ready for upscaling
	2.8.8 Packing of sweetpotato	Technology	Ready for upscaling
2.9 Sweetpotato value addition	2.9.1 Sweetpotato flour	Technology	Ready for upscaling
	2.9.2 Sweetpotato crisps	Innovation	Ready for upscaling
	2.9.3 Sweetpotato/wheat chapati	Innovation	Ready for upscaling
	2.9.4 Sweetpotato jam	Innovation	Ready for upscaling
	2.9.5 Sweetpotato mandazi	Innovation	Ready for upscaling
	2.9.6 Sweetpotato buns	Innovation	Ready for upscaling
	2.9.7 Sweetpotato fritters	Innovation	Ready for upscaling
	2.9.8 Sweetpotato chips/fries	Innovation	Ready for upscaling
	2.9.9 Sweetpotato/wheat noodles	Innovation	Requires validation
	2.9.10 Sweetpotato/wheat doughnuts	Innovation	Ready for upscaling
	2.9.11 Sweetpotato juice	Innovation	Ready for upscaling
	2.9.12 Sweetpotato biscuits	Innovation	Ready for upscaling
2.10 Mechanization of sweetpotato production activities	2.10.1 Power tiller	Technology	Ready for upscaling
	2.10.2 Wheeled tractor	Technology	Ready for upscaling
	2.10.3 Mouldboard plough	Technology	Ready for upscaling
	2.10.4 Harrow	Technology	Ready for upscaling
	2.10.5 Seedbed preparation	Management practice	Ready for upscaling
	2.10.6 Sweetpotato Transplanting	Technology	Requires validation
	2.10.7 Motorized Sprayer	Technology	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.10.8 Multifunction seedbed ridging machine	Innovation	Requires validation
	2.10.9 Seedling tray planter	Technology	Requires validation
	2.10.10 Fertilizer spreader	Technology	Ready for upscaling
	2.10.11 Sweetpotato machine Harvesting	Technology	Ready for upscaling
2.11 Business and Marketing	2.11.1 Models for market-oriented production of sweetpotato	Management practice	Ready for upscaling
	2.11.2 Developing a Business Plan for sweetpotato farming business.	Management practice	Ready for upscaling
	2.11.3 Marketing as a group - Collective marketing	Management practice	Ready for upscaling
	2.11.4 Profitability analysis - Reviewing sweetpotato Agro-enterprise	Management practice	Ready for upscaling
	2.11.5 Scaling up plan for sweetpotato agro-enterprise development approach	Management practice	Requires validation
	2.11.6 Contracted sweetpotato production model	Management practice	Requires upscaling
	2.11.7 Sweetpotato marketing enterprise model	Management practice	Ready for upscaling
	2.11.8 Internet/online/mobile marketing	Management practice	Ready for upscaling
2.12. Agricultural policy options	2.12.1 National Agricultural policy framework for smallholder farmers of sweetpotato	Management practice	Requires validation
	2.12.2 Policy options and objectives related to sweetpotato farming	Management practice	Requires validation
	2.12.3 Instruments of policy related to sweetpotato	Management practice	Requires validation
	2.12.4 Policy cycle for smallholder farmers policy issues and implementation.	Management practice	Requires validation
	2.12.5 Policy validation cycle for policy customization	Management practice	Requires validation
Total TIMPs	132		

2. DETAILED SWEETPOTATO VALUE CHAIN TIMPS

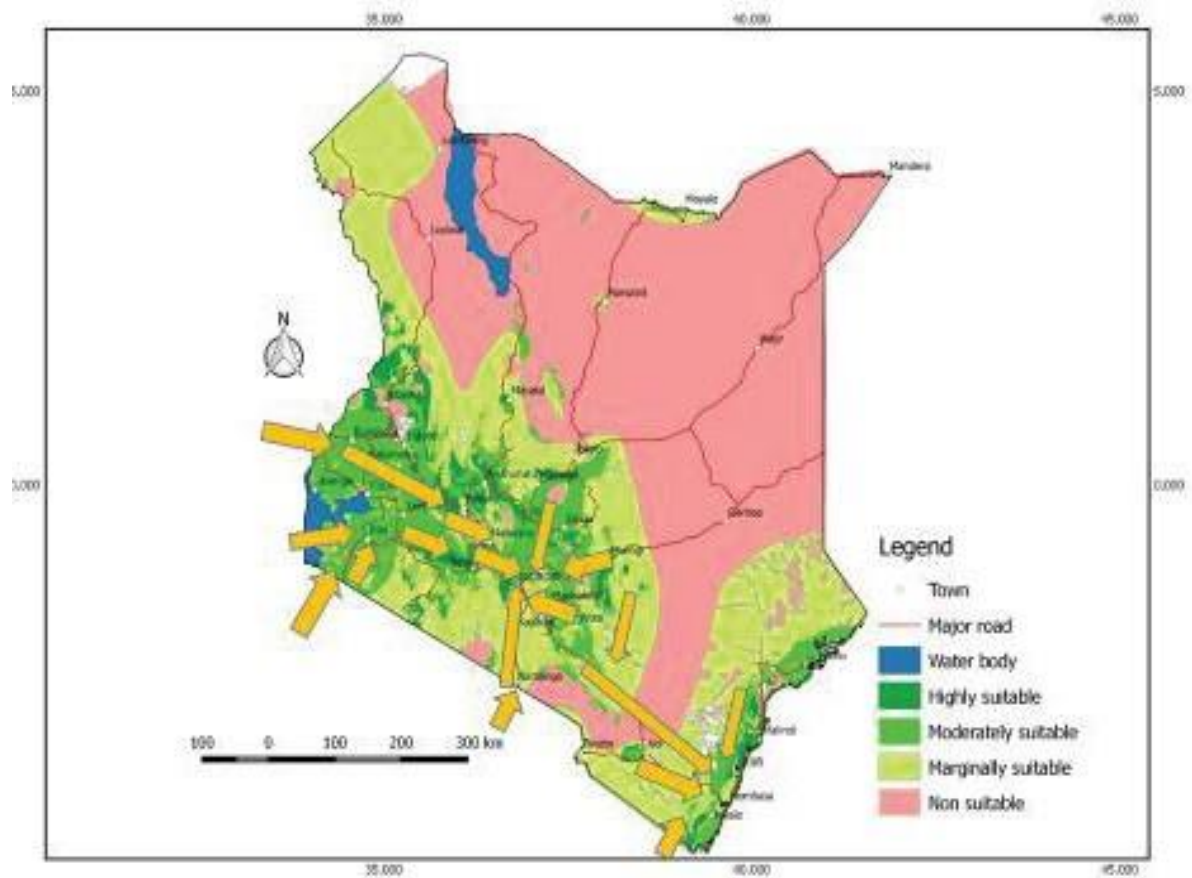



Figure 1 Suitability map of Sweetpotato in Kenya

2.1 IMPROVED SWEETPOTATO VARIETIES

2.1.1. Kenspot1

TIMP Name	Kenspot-1 (Nyawo) 
Category (i.e. Technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of commercially competitive varieties
What is it? (TIMP description)	Kenspot-1 (Nyawo) is a variety that is High yielding, with moderate dry matter (29.4%), yellow-fleshed, and average acceptability. It produces optimally at 1700-1900 m, matures within 6-7 months, and yields 23t/ha.
Justification	<ul style="list-style-type: none"> • High yielding, disease tolerant and marketable good quality variety • The increased production of the crop empowers farmers to compete in the local and export market. • This technology is one of those that has a potential to realize the expected impacts in one or more of the mentioned qualities required by the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension service providers, Traders, Consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory Implementation • Stakeholder capacity building • Stakeholder networks • Increasing productivity per unit • Efficient pest and disease management • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services.

respective roles.	<ul style="list-style-type: none"> Counties facilitate the extension by supporting the transportation of staff to sites and, being a channel for provision of grants to the farmers. CIGs play the role of adoption of the technologies through their various groups. Other service provider agencies including micro-finance agencies
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya, Nyanza, Trans-Nzoia, Elgeyo Marakwet, Nyamira, Bomet, Kericho, Nakuru, Turkana, West Pokot
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> Low uptake before the farmers see results Information on varietal availability is lacking Low market prices due to middlemen interferences. poor storability/transportability of technology Limited investment in the crop Limited publicity of the technology Nonexistent functional local processing and value addition facilities Low investment in research Applied and adaptive Research to test, validate and release improved sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Information packaging and dissemination in brochures Scaling up the technology at grass root level through FFBS On-farm demonstrations at strategic places accessible to target farmers Holding field days/open days Involvement of private operators, other government agencies (County, KEPHIS and MoALFC-AFA), Non-governmental agencies, can fast track the upscaling of the technology. Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	Preferred because of high dry matter suitable for snack
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> The crop is currently being produced in the county and is socially acceptable. The policy environment is conducive since the variety is registered and is appealing for market demand. Establishment of good channels for marketing of the produce to avoid exploitation by middle men. Establishing elaborate infrastructure for storage, grading and warehousing Identifying relevant financiers to support Gender inclusiveness in crop research and development Capacity building of stakeholders Understanding the physical and biotic Environment in target ecologies Understanding community culture, preferences, and practices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs/acre	KES 39,700 (26.5% of the total production cost)
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and	<ul style="list-style-type: none"> Men and women are consulted on preferred traits and these traits are considered in identifying the most suitable variety for their areas. Women are interested in food security so are likely to adopt improved

scaling up	<p>sweetpotato varieties that are high yielding.</p> <ul style="list-style-type: none"> • Male and female youth are more concerned about nutrition so they may easily take up the technology
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop

E: Case studies/profiles of success stories

Success stories	<ul style="list-style-type: none"> • High demand of sweetpotato attributable to the high nutritional value observed in other parts of Kenya. • Technology adoption among private players and NGOs is increasing • Individual farmers who have planted the variety are on the increase
Application guidelines for users	Sweetpotato production manuals and variety factsheets/leaflets

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-Njoro, P.O. Private Bag, 20107-Njoro
Lead organization/scientists	KALRO-Njoro – Joyce Malinga, Benjamin Kivuva, John Ndungu, David Lelgut, Ann Gichangi, Rosemary Cheboswony, Patrick Yegon and Ann Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.2. Kenspot5

TIMP Name	Kenspot5
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Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Lack of commercially competitive varieties
What is it? (TIMP description)	Kenspot5 has high beta carotene (4.7); moderate dry matter (25.9%) and moderate acceptability. It performs well in Western Kenya, Nyanza, Kericho, Nyamira, Bomet, Nakuru, Elgeyo marakwet and Trans-Nzoia. Yields 16.5 t/ha. Matures in 6-7 months and performs optimally at 1700-2100 m.
Justification	High yielding, marketable varieties are necessary to increase production for farmers in sweetpotato producing counties to compete in the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, seed dealers, researchers, extension service, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Development of agronomic practices for sweetpotato for Increasing productivity per unit • Participatory Implementation • Stakeholder capacity building • Stakeholder networks • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services • KALRO, National Universities, Colleges and International research organizations, to provide variety, seed and production information packages


	<ul style="list-style-type: none"> • Private Seed Companies for availing quality seed (Syngenta, Amiran, Simlaw, Kenya Seed Company, East Africa Seed, Continental Seed Company etc.) • Market players to create a demand and pull production • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya, Nyanza, Bomet, Kericho, Nyamira, Nakuru, Trans-Nzoia, Kericho, Elgeyo Marakwet
Counties where TIMPs will be upscaled	Migori County
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low uptake before the farmers see results • Limited investment in the technology • Limited publicity of the technology • No/few functional local processing facilities • Low investment in research • Unorganized marketing channels • Unavailability of quality seed and high seed cost • Limited access to rural finance for vegetable/fruit production
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms • Information packaging and dissemination in brochures • Scaling up the technology at grass root level through FFBS • Research to validate the technology • Information dissemination on production practices • Promotion of the variety in the suitable areas
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties
Social, environmental, policy and market conditions necessary for development and upscaling	Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs/acre	KES 39,700 (26.5% of the production cost)
Estimated returns/acre	KES 150,000
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Men and women are consulted on preferred traits and these traits are considered in identifying the most suitable variety for their areas. • Women are interested in food security so are likely to adopt improved sweetpotato varieties that are high yielding. • Women are more concerned about nutrition so they may easily take up the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through

	<p>participation in field comparisons with conventional varieties and in organoleptic tests</p> <ul style="list-style-type: none"> • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of sweetpotato due to nutritional high value in other parts of Kenya. • Technology adoption among private players and NGOs is increasing • Individual farmers who have planted the variety are on the increase
Application guidelines for users	Sweetpotato production guides/manuals and variety factsheets/leaflets
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Njoro, P.O. Private Bag, 20107-Njoro
Lead organization/scientists	KALRO-Njoro – Joyce Malinga, Benjamin Kivuva, John Ndungu, David Lelgut, Ann Gichangi Rosemary Chebwosony, Patrick Yegon and Ann Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties suitable for different agroecological zones
- Production of sweetpotato suitability map

2.1.3. Kenspot4

TIMP Name	<p>Kenspot4</p> 
Category (i.e. technology, innovation or management practice)	Technology


A: Description of the technology, innovation or management practice	
Problem to be addressed	Lack of commercially competitive varieties
What is it? (TIMP description)	Kenspot4 is OFSP, High dry matter (30.4%); high beta carotene (3.08); and average acceptability (3.2). Grown in following counties; Western Kenya, Nyanza, Bomet, Nakuru, Kericho, Uasin Gishu, Trans-Nzoia, West Pokot, Elgeyo Marakwet, Turkana East, Muranga, Embu and Machakos. It has fresh root yield of 18t/ha, maturity duration of 5-7 months, and grows optimally at 1700-2300 m.
Justification	The high yield attributes of this variety coupled with tolerance to Fusarium wilt and Downy mildew, its sweet crisp and juicy taste makes it a suitable candidate for evaluation with other varieties for its marketable potential towards increased production leading to farmers' transformed livelihoods in West Pokot County.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, seed dealers, researchers, extension service, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya, Nyanza and Central Rift
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Information on varietal availability is lacking • Low market prices due to middlemen interferences. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the technology at grass root level through FFBS • Planting demonstrations a strategic place accessible to target farmers

	<ul style="list-style-type: none"> • Holding field days/open days. • Establish sweetpotato innovation platforms.
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Highly preferred because of orange color and good milling properties
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Optimum yields obtained as per the technology • Establishment of good channels for marketing of the produce to avoid exploitation by middle men. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs/acre	KES 39,700 (26.5% of the total production cost)
Estimated returns/acre	KES 150,000
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Men and women are consulted on preferred traits and these traits are considered in identifying the most suitable variety for their areas. • Women are interested in food security so are likely to adopt improved sweetpotato varieties that are high yielding. • Women are more concerned about nutrition so they may easily take up the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	Sweetpotato production guides/manuals and variety factsheets/leaflets
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Njoro, P.O. Private Bag, 20107-Njoro
Lead organization/scientists	KALRO-Njoro – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.4. SPK 004 (Kakamega 4)

TIMP Name	<p style="text-align: center;">SPK 004 (Kakamega 4)</p> 
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Lack of commercially competitive varieties
What is it? (TIMP description)	SPK 004 is a variety with pink skin, orange-fleshed, Contains beta carotene, Tolerant to viruses and drought, high consumer acceptability. Processed into flour for making various products. Widely adopted. The variety is grown in Western Kenya, Nyanza. It yield 16.5t/ha, matures in 3-4 months, grows optimally at 1000-1900 m.
Justification	The high yield attributes of this variety coupled with high beta carotene, makes it a suitable candidate for evaluation with other varieties for its marketable potential towards increased production leading to farmers' transformed livelihoods.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, seed dealers, researchers, extension service, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit area • Efficient pest and disease management • Excellent storage and transportability traits enabling the technology to sell at distant markets. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services.

respective roles.	<ul style="list-style-type: none"> Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. CIGs play the role of adoption of the technologies through their various groups.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya and Nyanza
Counties where TIMPs will be up-scaled	Migori county
Challenges in development and dissemination	<ul style="list-style-type: none"> Low uptake before the farmers see results Information on varietal availability is lacking Low market prices due to middlemen interferences poor storability/transportability of technology Applied and adaptive Research to test, validate and release improved sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Information packaging and dissemination in brochures Scaling up the technology at grass root level through FFBS on-farm demonstrations at strategic places accessible to target farmers Holding field days/open days Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	It has higher consumer acceptability
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> Optimum yields obtained as per the technology potential Establishment of good channels for marketing of the produce to avoid exploitation by middle men. Establishing elaborate infrastructure for storage, grading and warehousing Identifying relevant financiers to support
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs/acre	KES 39,700
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Men and women are consulted on preferred traits and these traits are considered in identifying the most suitable variety for their areas. Women are interested in food security so are likely to adopt improved sweetpotato varieties that are high yielding. Women are more concerned about nutrition so they may easily take up the technology.
Gender related opportunities	<ul style="list-style-type: none"> Opportunities for women exists in sweetpotato processing, production, and marketing Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to productive resources such as land, credit and quality cuttings than men Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have less access to agricultural information, technology and knowledge than men

	<ul style="list-style-type: none"> • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of sweetpotato due to nutritional high value in other parts of Kenya. • Technology adoption among private players and NGOs is increasing • Individual farmers who have planted the variety are on the increase
Application guidelines for users	Sweetpotato production manuals and variety factsheets/leaflets
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-Kakamega, P.O. Box 169-50100, Kakamega
Lead organization/scientists	KALRO- Kakamega – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.5. Kenspot3

TIMP Name	Kenspot3
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	OFSP, High Dry Matter (32.5%), average beta carotene (1.08), average acceptability. The variety is grown in Western Kenya, Nyanza, Bomet, Nakuru, Kericho, Nyamira, Embu, Trans-Nzoia Elgeyo Marakwet. It yields about 18.5 t/ha, matures in 5-7 months, with optimal production at 1900-2300 m.
Justification	High yielding, marketable varieties are necessary to increase production for farmers in sweetpotato producing counties to compete in the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, extension agencies, trader (middle men), consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima programme” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools

	<ul style="list-style-type: none"> • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Participatory Implementation • Stakeholder capacity building • Stakeholder networks • Efficient pest and disease management • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya, Nyanza, Kericho, Bomet, Nyamira, Nakuru, Embu, Trans-Nzoia and Elgeyo Marakwet
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Limited investment in the technology • Limited publicity of the technology • No/few functional local processing facilities • Low investment in research • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the technology at grass root level through FFBS • on-farm demonstrations at strategic places accessible to target farmers • Holding field days/open days • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	Acceptable Beta Carotene level
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Identifying relevant financiers to support • Capacity building of stakeholders • Gender inclusiveness in crop research and development • Understanding the physical and biotic Environment in target ecologies • Optimum yields obtained as per the technology potential • Establishment of good channels for marketing of the produce to avoid exploitation by middle men. • Establishing elaborate infrastructure for storage, grading and warehousing • Understanding community culture, preferences, and practices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development,	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such

dissemination, adoption and scaling up	<ul style="list-style-type: none"> fertilizers than men as than men Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men The technology may not be adopted if the gender targeted especially women is overburdened Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> Opportunities for women exists in sweetpotato processing, production, and marketing Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to productive resources such as land, credit and quality cuttings than men Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have less access to agricultural information, technology and knowledge than men There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> Opportunities for youths exist in commercializing the technology Opportunities for youths exists in transportation of the produce to the market Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop

E: Case studies/profiles of success stories

Success stories	<ul style="list-style-type: none"> High demand of sweetpotato due to nutritional high value in other parts of Kenya. Technology adoption among private players and NGOs is increasing Individual farmers who have planted the variety are on the increase
Application guidelines for users	Sweetpotato production manuals/guides and variety factsheets/leaflets

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-Njoro, P.O. Private Bag, 20107-Njoro
Lead organization/scientists	KALRO-Njoro – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwozony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones

2.1.6. Kabode

TIMP Name	Kabode
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Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Lack of commercially competitive varieties
What is it? (TIMP description)	Variety Kabode has Purple skin, deep orange fleshed, 27.5% dry matter. It is grown in Western Kenya, Nyanza, Bomet, Nakuru, Trans-Nzoia (Kwanza, Saboti, Kitale town), Turkana, West Pokot. It yields 20.5 t/ha, matures within 4-5 months, and produces optimally at 1200-1800 m.
Justification	High yielding, marketable variety suitable for increased production in sweetpotato producing counties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, extension agencies, trader (middle men), consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management • Farmers • Extension agencies • Trader (middle men) • Consumers • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	


Counties where already promoted. if any	Western Kenya, Nyanza, Bomet, Nakuru, Embu and Trans-Nzoia
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	A highly marketable variety
Social, environmental, policy and market conditions necessary for development and upscaling	Stakeholder willingness to cooperate
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Men and women should be consulted on preferred traits during development of the variety. • Women are interested in food security so are likely to adopt improved sweetpotato varieties that are high yielding. • Women are more concerned about nutrition so they may easily take up the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya
Application guidelines for users	Sweetpotato production manuals and variety leaflets/factsheets

F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Katumani, P.O. Box 90100-340, Machakos
Lead organization/scientists	KALRO-Katumani – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.7. Vitaa

TIMP Name	<p>Vitaa</p> 
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	Variety Vitaa has Purple skin, orange fleshed, 25.8% dry matter. It is grown in Western Kenya, Nyanza, Bomet, Nakuru and Trans-Nzoia. It produces 18.5 t/ha, matures within 4 to 5 months, produces optimally at 1200-1800 m.
Justification	High yielding, marketable varieties are necessary to increase production for farmers in sweetpotato producing counties to compete in the market
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management

	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya, Nyanza, Bomet, Nakuru and Trans-Nzoia
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-Acceptable beta carotene levels
Social, environmental, policy and market conditions necessary for development and upscaling	Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such fertilizers than men as than men • Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests

	<ul style="list-style-type: none"> • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	Sweetpotato production manuals/guides and variety factsheets/leaflets
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Katumani, P.O. Box 90100-340, Machakos
Lead organization/scientists	KALRO-Katumani – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.8. Naspoti1

TIMP Name	Naspoti1
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	Dual purpose variety, yellow-fleshed, Vines harvested at 75 days and both roots and vines at 150 days. Moderate resistance to SPVD. It grown in Western, Eastern Kenya, North Rift region. It yields 24t/ha, matures within 3-4 months, and produces optimally within 1200-2000 m.
Justification	The high yield and dual-purpose attributes of this variety coupled with early maturity, makes it a suitable candidate for upscaling towards increased production leading to farmers' transformed livelihoods.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, researchers, traders (seed dealers, middle men), consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)

	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Adaptive Research to catalyze uptake of the improved sweetpotato variety • A platform for interaction of sweetpotato value chain stakeholders • Development of agronomic practices for sweetpotato for Increasing productivity per unit • Participatory Implementation • Stakeholder capacity building • Stakeholder networks • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services • KALRO, National Universities, Colleges and International research organizations, to provide variety, seed and production information packages • Private Seed Companies for availing quality seed (Syngenta, Amiran, Simlaw, Kenya Seed Company, East Africa Seed, Continental Seed Company etc.) • Market players to create a demand and pull production • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya
Counties where TIMPs will be upscaled	Migori county
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low uptake of technology before the farmers see results • Limited investment in the technology • Limited publicity of the technology • No/few functional local processing facilities • Low investment in research • Unorganized marketing channels • Unavailability of quality seed and high seed cost • Limited access to rural finance for vegetable/fruit production
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms • Information packaging and dissemination in brochures • Scaling up the technology at grass root level through FFBS • Research to validate the technology

	<ul style="list-style-type: none"> • Information dissemination on production practices • Promotion of the variety in the suitable areas
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the technology • Availability of market
Social, environmental, policy and market conditions necessary for development and upscaling	Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such fertilizers than men as than men • Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of sweetpotato due to nutritional high value in other parts of Kenya. • Technology adoption among private players and NGOs is increasing

	<ul style="list-style-type: none"> Individual farmers who have planted the variety are on the increase
Application guidelines for users	Sweetpotato production manuals/guides and variety factsheets/leaflets
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-Kakamega, P.O. Box 169-50100, Kakamega
Lead organization/scientists	KALRO-Kakamega – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.9. Irene

TIMP Name	Irene
Category (technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	<p>Growth characteristics, Plant type Erect, Leaf Green when mature, light green and purple edges when young, purple veins at top and under surfaces; with 5 deep lobes. Vine Purple mature sections and green meristem tops, short (3.5-5.0 cm) internodes, thin (4-6 mm) diameter.</p> <p>Flowering ability and habits: Late and sparse</p> <p>Major agronomic attributes, Potential maximum Root yields 19.6 t/ha, Adaptability; widely spread, Resistance to pests; High to sweetpotato weevils Resistance to sweetpotato diseases, tolerant to virus disease. Root Characteristics: Shape Oblong, Skin colour Purple red, Dry matter 28.8%, Flesh colour Orange with yellow, (28 C:18B) (CIP colour chart), β-carotene 8300 $\mu\text{g}/100\text{g}$ fw content,</p> <p>Sensory characteristics, Colour of boiled roots is Intermediate orange, Texture of boiled roots is Dry and floury mouth feel, Taste is moderately sweet. Matures in 4-5 months. It is grown in Makueni, Machakos, Kitui, Tharaka Nithi, and potential areas Siaya, Alupe, Embu and Kakamega</p>
Justification	High yielding, marketable with good shelf-life varieties are necessary to increase production for farmers in sweetpotato producing counties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, seed dealers, researchers, extension service, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) On-farm demonstration Field days Agricultural shows MoALFC/Extension officers Farmer to farmer Mass media – “Mkulima program”

	<ul style="list-style-type: none"> • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Development of agronomic practices for sweetpotato for increasing productivity per unit • Participatory Implementation • Stakeholder networks and capacity building • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services • KALRO, National Universities, Colleges and International research organizations, to provide variety, seed and production information packages • Private Seed Companies for availing quality seed (Syngenta, Amiran, Simlaw, Kenya Seed Company, East Africa Seed, Continental Seed Company etc.) • Market players to create a demand and pull production • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted. if any	Makueni, Machakos, Kitui, Tharaka Nithi and potential areas Siaya, Alupe, Embu and Kakamega
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low uptake before the farmers see results • Limited investment in the technology • Limited publicity of the technology • No/few functional local processing facilities • Low investment in research • Unorganized marketing channels • Unavailability of quality seed and high seed cost • Limited access to rural finance for vegetable/fruit production
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms • Information packaging and dissemination in brochures • Scaling up the technology at grass root level through FFBS • Research to validate the technology • Information dissemination on production practices • Promotion of the variety in the suitable areas
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties
Social, environmental,	<ul style="list-style-type: none"> • Optimum yields obtained

policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Harmonious gender consideration in research, consumption and marketing.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Men and women should be consulted on preferred traits during development of the variety. • Women are interested in food security so are likely to adopt improved sweetpotato varieties that are high yielding. • Women are more concerned about nutrition so they may easily take up the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of sweetpotato due to nutritional high value in other parts of Kenya. • Technology adoption among private players and NGOs is increasing • Individual farmers who have planted the variety are on the increase
Application guidelines for users	Sweetpotato production guides/manuals and variety leaflets/factsheets
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
Requires validation	
G: Contacts	
Contacts	Centre Director KALRO-Katumani, P.O. Box 90100-340, Machakos
Lead organization/scientists	KALRO-Katumani – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.10. Silklow6 (KatSP1)

TIMP Name	Silklow6 (KatSP1)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	<p>Plant type Semi-Erect to spreading, Leaf Green when mature, light green and purple edges when young, purple veins at top and under surfaces. Vine green on mature sections and green meristem tops. It is leafy and therefore it can serve as a source of forage.</p> <p>Flowering ability and habits: Late and sparse</p> <p>Major agronomic attributes, Potential maximum Root yields 20 t/ha, Adaptability; widely spread, Resistance to pests; moderate to sweetpotato weevils, moderate resistance to sweetpotato virus disease. Has moderate tolerance to low cool temperature.</p> <p>Root Characteristics: Shape Oblong, Skin colour Purple red, Dry matter 26.1%, Flesh colour Orange (29A/23) (CIP colour chart), β-carotene 4800 $\mu\text{g}/100\text{g}$ fwb content,</p> <p>Sensory characteristics, Colour of boiled roots is intermediate orange, texture of boiled roots is dry and floury mouth feel, Taste is sweet, It is grown at Bungoma, Kakmega Homabay, Kisii Tharaka Nithi, Kiambu, Embu, Meru, Nyeri, Muranga, Taita Taveta-Wundanyi, Machakos. Matures in 4-5 months.</p>
Justification	The high yield attributes of this variety coupled with tolerance to high beta carotene, makes it a suitable candidate for evaluation with other varieties for its marketable potential towards increased production leading to farmers' transformed livelihoods.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, seed dealers, researchers, extension service, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Development of agronomic practices for sweetpotato for Increasing productivity per unit • Participatory Implementation • Stakeholder capacity building • Stakeholder networks

	<ul style="list-style-type: none"> • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services • KALRO, National Universities, Colleges and International research organizations, to provide variety, seed and production information packages • Private Seed Companies for availing quality seed (Syngenta, Amiran, Simlaw, Kenya Seed Company, East Africa Seed, Continental Seed Company etc.) • Market players to create a demand and pull production • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Bungoma, Kakamega, Homabay, Kisii, Tharaka Nithi, Kiambu, Embu, Meru, Nyeri, Muranga, Taita Taveta-Wundanyi, Machakos.
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low uptake before the farmers see results • Limited investment in the technology • Limited publicity of the technology • No/few functional local processing facilities • Low investment in research
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms • Information packaging and dissemination in brochures • Research to validate the technology at grass root level through FFBS
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Optimum yields obtained as per the technology • Establishment of good channels for marketing of the produce to avoid exploitation by middle men. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Men and women should be consulted on preferred traits during development of the variety. • Women are interested in food security so are likely to adopt improved sweetpotato varieties that are high yielding. • Women are more concerned about nutrition so they may easily take up the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exist in sweetpotato processing, production, and marketing

	<ul style="list-style-type: none"> • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop

E: Case studies/profiles of success stories

Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	Sweetpotato production guides/manuals and variety factsheets/leaflets

F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)

Requires validation

G: Contacts

Contacts	Centre Director KALRO-Katumani, P.O. Box 90100-340, Machakos
Lead organization/scientists	KALRO-Katumani –J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.11. Shock5 (KatSP5)

TIMP Name	Shock5 (KatSP5)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	<p>Growth characteristics, Plant type spreading, Leaf Green when mature, light green when young. Vine green mature and green meristem tops. It is leafy and therefore it can serve as a source of forage.</p> <p>Flowering ability and habits: Late and sparse</p> <p>Major agronomic attributes, Dual purpose variety, Potential maximum Root yields 20t/ha, Adaptability; widely spread, Medium resistance to pests; moderate to sweetpotato weevils, moderate to sweetpotato diseases, moderate to virus disease. Has moderate tolerance to low cool temperature. Root Characteristics: Shape Oblong, Skin colour cream</p>

	white, Dry matter 25.8%, Flesh colour cream yellow, (9D/3) (CIP colour chart), β -carotene 1500 μ g/100g fw content, Sensory characteristics Colour of boiled roots is Intermediate cream white, Texture of boiled roots is Dry and floury mouth feel, Taste is sweet
Justification	The high yield attributes of this variety coupled with its suitability for animal forage make it a suitable candidate for evaluation with other varieties for its marketable potential towards increased production leading to farmers' transformed livelihoods.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, seed dealers, researchers, extension service, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management • Tolerance/resistance to extreme heat
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	Bungoma, Kakamega, Homabay, Kisii Tharaka Nithi, Kiambu, Nakuru, Nyandarua, Embu, Meru, Nyeri, Muranga, Taita Taveta-Wundanyi, Machakos
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see the results • Information on varietal availability is lacking • Low market prices due to middlemen interferences. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the technology at grass root level through FFBS • Planting demonstrations a strategic place accessible to target farmers • Holding field days/open days

	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	Good for animal forage
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Optimum yields obtained as per the technology • Establishment of good channels for marketing of the produce to avoid exploitation by middle men. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Men and women should be consulted on preferred traits during development of the variety. • Women are interested in food security so are likely to adopt improved sweetpotato varieties that are high yielding. • Women are more concerned about nutrition so they may easily take up the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	Sweetpotato production guides/manuals and variety factsheets/leaflets
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Katumani, P.O. Box 90100-340, Machakos
Lead organization/scientists	KALRO-Katumani –J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.12. Mwavuli


TIMP Name	Mwavuli
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Lack of commercially competitive varieties
What is it? (TIMP description)	High root yield, cream fleshed, high DM, high vine production, dual purpose. Boiling, roasting. It is grown in Western Kenya, Nyanza. It yield 22 t/ha. Matures in 4-5 months and produces optimally at 1200-1800 m
Justification	High yielding varieties are necessary to increase production for farmers in sweetpotato producing counties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, seed dealers, researchers, extension service, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Efficient pest and disease management • Excellent storage and transportability traits enabling the technology to sell at distant markets • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya, Nyanza.
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Information on varietal availability is lacking • Low market prices due to middlemen interferences. • Applied and adaptive Research to test, validate and release improved

	<p>sweetpotato varieties</p> <ul style="list-style-type: none"> • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the technology at grass root level through FFBS • On-farm demonstrations at strategic places accessible to target farmers • Holding field days/open days • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> - A high yielding variety preferred by farmers
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Optimum yields obtained as per the technology potential • Establishment of good channels for marketing of the produce to avoid exploitation by middle men. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	
Gender related opportunities	
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Men and women should be consulted on preferred traits during development of the variety. • Women are interested in food security so are likely to adopt improved sweetpotato varieties that are high yielding. • Women are more concerned about nutrition so they may easily take up the technology.
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of sweetpotato due to nutritional high value in other parts of Kenya. • Technology adoption among private players and NGOs is increasing • Individual farmers who have planted the variety are on the increase
Application guidelines for users	Sweetpotato production manuals/guides and variety factsheets/leaflets
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Kakamega, P.O. Box 169-50100, Kakamega
Lead organization/scientists	KALRO-Kakamega – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gap

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.13. Mugande

TIMP Name	Mugande 
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	Red skinned and white-fleshed, High DM, good taste, good root shape (dual purpose). It yields 20t/ha. Matures within 4-5 months. It produces optimally at 1000-1700 m
Justification	High yields, and high starch content increase production for farmers in sweetpotato producing counties
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, seed dealers, researchers, extension service, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets). • Agriculture Innovation Platforms • Farmer Field and Business Schools •
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit area • Efficient pest and disease management • Excellent storage and transportability traits enabling the technology to sell at distant markets. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the

	<p>farmers.</p> <ul style="list-style-type: none"> • CIGs play the role of adoption of the technologies through their various groups. • Other service provider agencies including micro-finance agencies
C: Current situation and future scaling up	
Counties where already promoted. if any	All over the country
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Information on varietal availability is lacking • Low market prices due to middlemen interferences. • Limited publicity of the technology • Low investment in research • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • validation of the technology at grass root level through FFBS • On-farm evakuation at strategic places accessible to target farmers • Holding field days/open days • Involvement of private operators, other government agencies (County, KEPHIS and MoALFC-AFA), Non-governmental agencies, can fast track the upscaling of the technology. • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	- Adapts well across sweetpotato growing zones of Kenya
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • The crop is currently being produced in the county and is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of good channels for marketing of the produce to avoid exploitation by middle men. • Identifying relevant financiers to support the technology • Gender inclusiveness in crop research and development • Capacity building of stakeholders • Understanding the physical and biotic Environment in target ecologies • Understanding community culture, preferences, and practices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such fertilizers than men as than men • Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic

	<ul style="list-style-type: none"> • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop

E: Case studies/profiles of success stories

Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	Sweetpotato production guides/manuals, variety factsheets and leaflets

F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)

Requires validation

G: Contacts

Contacts	Centre Director KALRO-Kakamega, P.O. Box 169-50100, Kakamega
Lead organization/scientists	KALRO-Kakamega – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwozony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.14. Kemb10

TIMP Name	Kemb10
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	Kemb10 has Yellow-fleshed roots, Sweet taste when boiled or roasted. It grows well in Western Kenya and Eastern Kenya. It yields at 20.5t/ha, matures in 3 -4 months. Produces optimally at 1000-1800 m.

Justification	High yielding, marketable with good shelf-life varieties are necessary to increase production for farmers in sweetpotato producing counties to compete in the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya and Eastern Kenya
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	- Yellow-fleshed roots and Sweet taste when boiled or roasted are the parameters loved by farmers.
Social, environmental, policy and market conditions necessary for development and upscaling	- Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre

Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such as fertilizers than men • Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop

E: Case studies/profiles of success stories

Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	Sweetpotato production manuals and Variety leaflets.

F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)

Requires validation


G: Contacts

Contacts	Centre Director KALRO-Kakamega, P.O. Box 169-50100, Kakamega
Lead organization/scientists	KALRO-Kakamega – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gaps

- Determination of sweetpotato varieties adaptable to different agroecological zones
- Production of sweetpotato suitability map

2.1.15. Jankaroti

TIMP Name	Jankaroti 
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	Cream skin, Orange-fleshed-rich in beta carotene, acceptable levels of dry matter content, moderately tolerant to SPVD. It is grown in western Kenya, yield 21t/ha, matures in 3-4 months, produces optimally at 1200-2000 m.
Justification	High yielding, marketable with good shelf-life varieties are necessary to increase production for farmers in sweetpotato producing counties to compete in the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya


Counties where TIMPs will be upscaled	West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-Acceptable dry matter and orange fleshed color appeals to the end users
Social, environmental, policy and market conditions necessary for development and upscaling	-Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such as fertilizers than men • Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the

	market
	<ul style="list-style-type: none"> • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	Reference <ul style="list-style-type: none"> • Seeds sweetpotato Astrakhan Giant Vegetable Planting Organic Heirloom Ukraine.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Kakamega, P.O. Box 169-50100, Kakamega
Lead organization/scientists	KALRO-Kakamega – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwozony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gap

- Determination of sweetpotato varieties adaptable to different agroecological zones

2.1.16. Cuny (Kuny Kibwonjo)

TIMP Name	Cuny (Kuny Kibwonjo) 
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	High dry matter content, yellow-fleshed, has average level of sugars, Tolerant to Altanaria, High consumer acceptance rating. Yields 25t/ha, matures in 4-5 months, and production is optimal at 1200-1800 m.
Justification	High yielding varieties are necessary to increase production for farmers in sweetpotato producing counties to compete in the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)

	<ul style="list-style-type: none"> • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	- It has highest consumer rating because of acceptable dry matter and orange color.
Social, environmental, policy and market conditions necessary for development and upscaling	-Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such fertilizers than men as than men • Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men

Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop

E: Case studies/profiles of success stories

Success stories	-High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	References <ul style="list-style-type: none"> • Seeds sweetpotato Astrakhan Giant Vegetable Planting Organic Heirloom Ukraine.

F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research) Requires validation


G: Contacts

Contacts	Centre Director KALRO-Kakamega, P.O. Box 169-50100, Kakamega
Lead organization/scientists	KALRO-Kakamega – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gap

- Determination of sweetpotato varieties adaptable to different agroecological zones

2.1.17. Namnyekera

TIMP Name	Namnyekera 
Category (i.e. technology, innovation or management practice)	Technology

A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	Yellow-fleshed with high consumer acceptance rating, moderately resistance to weevil attack due to its deep rooting characteristics, resistance to Alternaria. It is produced mainly in western Kenya. Yields 25t/ha, matures in 4-5 months, and produces optimally at 1200-2000 m.
Justification	High yielding, marketable with good shelf-life varieties are necessary to increase production for farmers in sweetpotato producing counties to compete in the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	- Moderately resistance to weevils therefore suita


Social, environmental, policy and market conditions necessary for development and upscaling	Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such as fertilizers than men • Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	Reference <ul style="list-style-type: none"> • Seeds sweetpotato Astrakhan Giant Vegetable Planting Organic Heirloom Ukraine.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Kakamega, P.O. Box 169-50100, Kakamega

Lead organization/scientists	KALRO-Kakamega – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwozony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

Research gap

- Determination of sweetpotato varieties adaptable to different agroecological zones

2.1.18. Kenspot2

TIMP Name	Kenspot2 
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	High yielding, moderate dry matter (26.2%), cream skin, yellow-fleshed, high acceptability. It is produced Western Kenya, Nyanza, Nakuru, Bomet, Kericho. Yields 21.2t/ha, matures in 6-7 months, and produces optimally at 1700-2300 m.
Justification	High yielding, marketable with good shelf-life varieties are necessary to increase production for farmers in sweetpotato producing counties to compete in the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the

	technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya, Nyanza, Nakuru, Bomet and Kericho
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	- Acceptable dry matter and yields by farmers
Social, environmental, policy and market conditions necessary for development and upscaling	Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such as fertilizers than men • Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through participation in field comparisons with conventional varieties and in organoleptic tests • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and

	<p>knowledge than men</p> <ul style="list-style-type: none"> • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	<p>Reference</p> <ul style="list-style-type: none"> • Seeds sweetpotato Astrakhan Giant Vegetable Planting Organic Heirloom Ukraine.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Njoro, P.O. Box , private bag, 20107-Njoro
Lead organization/scientists	KALRO-Njoro – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwozony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

2.1.19. Bungoma

TIMP Name	Bungoma
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of improved sweetpotato varieties
What is it? (TIMP description)	Cream skin, Orange-fleshed-rich in beta carotene, acceptable levels of dry matter content, moderately tolerant to SPVD. It is grown in western Kenya, yield 21t/ha, matures in 3-4 months, produces optimally at 1200-2000 m.
Justification	High yielding, marketable with good shelf-life varieties are necessary to increase production for farmers in sweetpotato producing counties to compete in the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for	<ul style="list-style-type: none"> • Increasing productivity per unit

successful promotion	<ul style="list-style-type: none"> • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-It is moderately tolerant to SPVD
Social, environmental, policy and market conditions necessary for development and upscaling	Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 39,700 per acre
Estimated returns	KES 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding and processing activities • Women and youth may have limited access to farm inputs such fertilizers than men as than men • Women and youth may have less access to productive resources such as credit, labour land and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exists in sweetpotato processing, production, and marketing • Women play a key role in testing the suitability of the variety through

	<p>participation in field comparisons with conventional varieties and in organoleptic tests</p> <ul style="list-style-type: none"> • Opportunities for youths exists in transportation of the produce to the market
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit and quality cuttings than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exist in commercializing the technology • Opportunities for youths exists in transportation of the produce to the market • Opportunities exist for VMGs to improve their food and nutritional security through consumption of the crop
E: Case studies/profiles of success stories	
Success stories	High demand of sweetpotato due to nutritional high value in other parts of Kenya.
Application guidelines for users	<p>Reference</p> <ul style="list-style-type: none"> • Seeds sweetpotato Astrakhan Giant Vegetable Planting Organic Heirloom Ukraine.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Kakamega, P.O. Box 169-50100, Kakamega
Lead organization/scientists	KALRO-Kakamega – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities










Research gap

- Determination of sweetpotato varieties adaptable to different agroecological zones

2.2 SWEETPOTATO SEED SYSTEMS

2.2.1. Tissue culture sweetpotato plantlets

TIMP Name	Tissue Culture Plantlets
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	Selecting health sp roots for sprouting	Sprouting of sp storage roots	Slicing of the meristem
			
	Geminating the meristem on growth media	Establishing plantlets in growth media	Cultured meristems in growth media containers
			
Multiplying established plantlets	Multiplying the planted in green house	Hardening the plantlets in seedling trays	
Category (i.e. technology, innovation or management practice)	Technology		
A: Description of the technology, innovation or management practice			
Problem to be addressed	Virus infected planting materials		
What is it? (TIMP description)	Sweetpotato plants infected with virus with symptoms of severe stunting, leaves that are small and narrow (straplike) with distorted edge; puckering, vein-clearing, and mottling and the whole plant may appear chlorotic (yellowing), record yield reduction of upto 90%. These plants are clean using tissue culture technology where virus free sweetpotato plantlets are produced through apical meristem tissue culture technique.		
Justification	<ul style="list-style-type: none"> • Most farmers do not have access to virus free sweetpotato seed at onset of rains • Recycled seed reduces the yield by 50 % every time • Infested sweetpotato seed result to upto 100% yield loss • Use of virus free clean seed optimize the yield 		
B: Assessment of dissemination and scaling up/out approaches			
Users of TIMP	Farmers, nursery operators, Traders, Researchers, Extension service.		
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • MoALFC/Extension officers • Farmer research networks • Farmer to farmer • Promotional materials (posters/brochures/leaflets, manuals) • Web material's • Farmer Field Business Schools • Innovation Platforms 		
Critical/essential factors for	<ul style="list-style-type: none"> • Seed availability and accessibility 		

successful promotion	<ul style="list-style-type: none"> • Good seed system to ensure quality • Trained nursery operators on good nursery management practices. • Well organized farmer groups and networks • County and central government support
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • KALRO Seed Unit and other Seed companies for certified seed production and distribution • Agro dealers for certified seed distribution propagation material and other farm inputs • Farmers/farmer groups to adopt and propagate seedlings • Financial institutions e.g. Banks, donors and other credit facilitators for financial solutions • Research organizations, universities will do more research on the technology.
C: Current situation and future scaling up	
Counties where already promoted, if any	Nakuru, Migori, Elgeyo Marakwet and Trans-Nzoia
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Most farmer have not embraced the practice of propagation by using trays and soilless media. • Lack of awareness by most nursery operators
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Facilitating information packaging and dissemination in brochures on the advantages of using trays to trigger demand • Scaling up and promotion of existing nurseries on embracing the management practice
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Great method for delivering bulk seed to farmers that are virus free
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Channeling of more resources on the promotion of the management practices to create more awareness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 4,000
Estimated returns	Can be established by research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth may have less access to productive resources such as credit, labour and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for women and youths in production of seedlings in trays for sale to other farmers • Opportunities for youths exists in transportation of the seedlings to the end users

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs may have less access to productive resources such as credit, labour and quality cuttings than men • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for Youths and other VMGs in the provision of quality seedlings through registered nurseries and agro based stores • Opportunities for youths exists in transportation of quality seedlings to the end users

E: Case studies/profiles of success stories

Success stories	-Distribution of clean seed to western Kenya and Nyanza e.g Migori which has changed farmers fortunes
Application guidelines for users	<ul style="list-style-type: none"> • This is a technology where coco peat is used as a substrate by filling in germination trays, then sweetpotato seed is sown at 1.2 cm-1.9 cm depth and kept under a shade net or green house to start germination. The media is moistened to facilitate moisture absorption by the seed to facilitate germination. • The seedling is allowed to develop a minimum of five leaves before transplanting in the field. Some form of hardening is done before the seedlings are transplanted. • The trials which will be undertaken in a participatory manner will help to identify the best performing varieties. • Selected varieties will be planted on-farm using a preferred methodology to test the various varieties and have the conventional one as control. • Data will be collected in collaboration with farmers (FFS approach) to enable the farmers fully participate in the project and finally identify the best performing varieties after analysis of the data. • Good agricultural practices will be adopted throughout the trial to ensure good results are obtained.

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-Njoro, P.O. Private Bag, 20107-Njoro
Lead organization/scientists	KALRO-Njoro – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwozony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

2.2.2. Rapid vine multiplication

TIMP Name	Rapid Vine Multiplication
	

Category (i.e. technology, innovation or management practice)	Complementary Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Inadequate availability of sweetpotato quality seed
What is it? (TIMP Description)	<p>Rapid vine multiplication This technique is used to increase planting materials when they are in short supply to ensure sufficient seed for timely planting in the field at the onset of rains. A standard rapid multiplication bed is 1m wide by 5 m long, with 50 cm space between beds if same variety and 1.0 m apart when neighbouring beds have different varieties.</p> <p>Well rotten farm yard manure or compost should be used together with for example 25 gm of N:P:K (17:17:17) per m² of the nursery bed. Only cuttings taken from healthy, disease and pest-free vines of 2 to three months old plants should be used. Each cutting should be three nodes long (mini-stem cutting). A node is the bump at which the leaves branch off.</p> <p>The 3 node cuttings should be planted upright or at a slant at a spacing of 10 cm x 20 cm, with at least two of the nodes buried under the soil, to encourage root development and faster plant growth. This planting layout uses about 50 cuttings per m² achieving 250 mini stem cuttings on a 1.0 m x 5.0 m bed.</p> <p>The nursery bed must be watered gently two or more times a day. Keep the nursery bed weed free by pulling weeds out and once the crop establishes, weeds are suppressed by the vegetative cover.</p>
Justification	Inadequate availability of quality planting materials for sweetpotato at the onset of rainfall, remains a major bottleneck in sweetpotato farming. This inadequacy may be solved by application of rapid seed multiplication technology that results to high turnover of sweetpotato cuttings for planting.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, nursery operators, Researchers, Extension service.
Approaches used in dissemination	<ul style="list-style-type: none"> • On station research trials and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • MoALFC/Extension officers • Farmer research networks • Farmer to farmer • Promotional materials (posters/brochures/leaflets, manuals) • Web material's • Farmer Field Business Schools • Innovation Platforms On-farm demonstration
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Most farmer have not embraced the practice of propagation by using cuttings • Lack of awareness by most nursery operators and farmers
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • KALRO Seed Unit and other Seed companies for propagation. • Farmers/farmer groups to adopt and propagate seedlings • Research organizations, universities will do more research on the

	technology
C: Current situation and future scaling up	
Counties where already promoted. if any	- Migori, Trans-Nzoia and Elgeyo Marakwet
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Most farmer have not embraced the technology of propagation by pre-germinating seeds. • Lack of awareness by most nursery operators
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Facilitating information packaging and dissemination in brochures on the advantages of using trays to trigger demand • Scaling up and promotion of existing nurseries on embracing the management practice
Lessons learnt in upscaling, if any	Pre-germination permits uniform germination of seed.
Social, environmental, policy and market conditions necessary for development and upscaling	-
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 4,000 per acre
Estimated returns	To established through research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth may have less access to productive resources such as credit, land, labour and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for women and youths in production of quality cuttings for sale to other farmers • Opportunities for youths exists in transportation of the cuttings to the end users
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs may have less access to productive resources such as credit, labour, land and quality cuttings than men • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youths and other VMGs in the provision of quality cuttings through registered nurseries and agro-based stores • Opportunities for youths exists in transportation of quality cuttings to the end users
E: Case studies/profiles of success stories	
Success stories	- Migori and Elgeyo Marakwet have used this technology through farmers nurseries to distribute seed to sweetpotato growers.
Application guidelines for	<ul style="list-style-type: none"> • Seeds are soaked in clear water for 30 minutes then they are removed

users	<p>and placed on wet towel and kept in a dark warm place for 24 hours after which they will sprout.</p> <ul style="list-style-type: none"> • It is after this that the sprouted seeds are transferred to the soil in the field as a sure method that the seed is viable and provide a solution for the farmers who would otherwise have waited for over 5 days before ascertaining seed viability. • Adoption of good agricultural practices
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-Katumani, P.O. Box , 90100-340, Machakos
Lead organization/scientists	KALRO-Katumani – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

2.2.3. Conventional vine multiplication in the field

TIMP Name	Conventional vine multiplication in the field
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Cost of seed and the uniformity of plants
What is it? (TIMP Description)	Vine cuttings of at least 3 nodes are planted in the field at 50 cm x 20-30 cm. Vine cuttings are planted either on flat ground or on small ridges spaced at 50 cm apart. The field should be kept weed free and any diseased plants rogued out. Vines will be ready for harvesting 6-8 weeks after planting. Plant population is twice that of root production and priority is seed though some roots can also be harvested in such a field. If solely planted for vines then Nitrogenous fertilizer (20 Kg N/acre) should be applied after every harvest.
Justification	Inadequate availability of quality planting materials for sweetpotato at the onset of rainfall, remains a major bottleneck in sweetpotato farming. This inadequacy may be solved by application of rapid seed multiplication technology that results to high turnover of sweetpotato cuttings for planting.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, nursery operators, Traders, Researchers, Extension service
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Awareness of challenges of low germination in the field. • High cost of seed thus the need to minimize losses • The need for uniformity of plants in the field
Partners/stakeholders for	Research institution, universities, vegetable nurseries they are the

scaling up and their respective roles.	recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	Cuttings may have difficulty fruiting if they're taken too late in the season
Suggestions for addressing the challenges	Taking cutting from a plant grown completely indoors
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Channeling of more resources on the promotion of the technology to create more awareness
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 4,000 per acre
Estimated returns	To be established through research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth may have less access to productive resources such as credit, land, labour and quality cuttings than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for women and youths in production of quality cuttings for sale to other farmers • Opportunities for youths exists in transportation of the cuttings to the end users
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs may have less access to productive resources such as credit, labour, land and quality cuttings than men • VMGs have less access to agricultural information, technology and knowledge than men • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youths and other VMGs in the provision of quality cuttings through registered nurseries and agro-based stores • Opportunities for youths exists in transportation of quality cuttings to the end users
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	-
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation

G: Contacts	
Contacts	Centre Director KALRO-Njoro, P.O. Box , private bag, 20107-Njoro
Lead organization/scientists	KALRO-Njoro – J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwozony, P Yegon and A Mulwa
Partner organizations	Seed and chemical companies, Universities, Other research organizations

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

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

TIMP Name	Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for sweetpotato Value Chain in Kenya
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	<p>The presence of chemical, biological and physical hazards in the sweetpotato value chain in Kenya have a direct effect on consumer's health thereby constantly increasing demand for high quality of the crop and it's by products from consumers and public health departments in counties. These hazards have direct economic consequences affecting families, communities and industries subsisting on the sweetpotato value chain in Kenya. This ultimately leads to reduced productivity of the active population in the country.</p> <p>The biological contaminations previously reported on this value chain include presence of <i>Escherichia coli</i> (E. coli), <i>Salmonella</i> spp., <i>Aspergillus flavus</i> and <i>Aspergillus parasiticus</i>.</p> <p>The chemical hazards due to heavy metal accumulations like lead/mercury/cadmium and MRLs above permitted levels from pesticides have also previously been detected. These hazards cause neurological disorders, cancer and birth defects to the consumers in the value chain.</p>
What is it? (TIMP description)	<p>Food safety management system (FSMS) through Hazard Analysis and Critical Control Point (HACCP) in sweetpotato value chain is a system of food safety monitoring and control based on the systematic identification and assessment of various hazards. It is a preventive, rather than a reactive, tool that places the protection of the sweetpotato supply from biological, chemical and physical hazards into the hands of food management systems.</p> <p>This HACCP system is designed to minimize the risk of food safety hazards by identifying the hazards, establishing controls and monitoring these controls. When this HACCP concept is applied to the management of likely adverse health effects resulting from exposure to hazards in the sweetpotato value chain a wholesome and safe sweetpotato value chain can be maintained improving on trade and health within and without Kenya borders.</p>

Justification	<p>The only important tool kit to assure food safety through monitoring in the sweetpotato value chain is the Hazard Analysis and Critical Control Points (HACCP) system. This critical tool is already incorporated into the Codex Alimentarius of the world as well as into the national public health food safety legislations of Kenya.</p> <p>The HACCP approach can be applied to all stages of the sweetpotato value chain process, ranging from production to processing, transportation, retail in commercial establishments and/or direct utilization by the consumer. Through its application, food safety charts in the sweetpotato value chain will easily be identified through critical control points. This will set limitation values for monitoring so that action can be taken if the set point values of hazards are out of the defined range required.</p> <p>In this sweetpotato value chain, the proposed FSMS that will be adopted, different hazards would be minimized in every phase of production, harvesting, processing, distribution and consumption making sweetpotato grain safe for consumption by Kenyans.</p> <p>Key elements will be identified that will be used or modified to reduce hazards formation in all steps of production to consumption.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Sweetpotato value chain actors from farmers, traders, food vendors and consumers.
Approaches used in dissemination	<ul style="list-style-type: none"> • The National and County level • Common Interest Groups discussions • Field days • Exhibitions, • Electronic media (radio, TV) • Social media (Whats App, Facebook, Twitter). • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • An expert team composed of HACCP specialist, food scientist, microbiologist, representative of the sweetpotatonut growers, public health officer, and a quality control and safety specialist from the Kenya Bureau of Standards will be formulated. • Distribution of the printed HACCP plan to sweetpotato value chain actors for implementation in order to reduce hazards. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • Institutions with IPM and Integrated Crop Management (ICM) programs • Institutions responsible for legislating in food safety, regulations and sale of pesticides • Institutions with the required analytical testing • Training institutions with extension programs to producers and other actors on the chain • Producers and exporters associations. • County extension staff • Universities (Public and Private)

	<ul style="list-style-type: none"> • NGOs • Private sector • Processors and local traders
C: Current situation and future scaling up	
Counties where already promoted. if any	-
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Inadequate funds to reach value chain actors • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Funding of dissemination platforms • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	The policies and laws in public health in place in Kenya are supportive to the use of HACCP Plan in sweetpotatonut value chain.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as quality cuttings than men. • Women and youth may have less access to credit than men • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Proper application of HACCP will lead to improved health of the various gender categories such as women • Use of the farmer field and business school strategy for effective training of farmer groups on sweetpotato production and marketing • Opportunities for youths and women exists in sweetpotato production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Requires a lot of movement on the farm to maintain records and process verification which may be untenable by some VMGs who are elderly and disabled • VMGs may have less access to markets • VMGs have limited access to land for sweetpotatoes cultivation than men • VMGs may have less access to credit • VMGs have less access to agricultural information, technology and knowledge than men • High illiteracy level of the VMGs makes them unable to read the dissemination documents and other materials
VMG related opportunities	<ul style="list-style-type: none"> • Affirmative action in the provision of finances to VMGs • Opportunities exist for youth in the transportation hub of quality sweetpotatoes cuttings

	<ul style="list-style-type: none"> Increased production will lead to increased consumption and utilization of sweetpotatoes hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<ul style="list-style-type: none"> KALRO KCSAP Biological Hazards factsheet KALRO KCSAP Food Safety Culture factsheet KALRO KCSAP Chemical Hazards factsheet <p>KALRO KCSAP Hazard Analysis Critical Control Point (HACCP) factsheet</p>
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling;
G: Contacts	
Contacts	<ul style="list-style-type: none"> Director General, KALRO, Dr. Joyce Maling'a, Institute Director, KALRO-Kitale. Dr. Godwin Macharia - Centre Director, KALRO-Njoro
Lead organization/scientists	<ul style="list-style-type: none"> Mr. John N. Ndung'u, KALRO-Njoro Mr. Athony Nyaga, KALRO PTC Dr. Francis Wayua, KALRO-Kakamega Dr. Lusike Wasilwa, Crops Director, KALRO-HQ Mrs. Violet Kirigua, KALRO-HQ Beatrice Wanjiku, KALRO-Njoro
Partner organizations	MoALFC, AFA, FPEAK, PCPB, AAK, KEPHIS, County governments, NGOs, Universities

2.3.2. Good Agricultural Practices (GAP) for sweetpotato


TIMPs name	Good Agricultural Practices (GAP) for sweetpotato
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> Declining food safety Reduced food quality Sustainable farming practices Reduced environmental impact Worker safety and health Traceability
What is it? (TIMP description)	<p>The four 'pillars' of GAP (economic viability, environmental sustainability, social acceptability and food safety and quality) are included in most private and public sector standards, but the scope which they actually cover varies widely.</p> <p>It is a systematic process of implementing a standardized production system globally designed to reassure consumers about how food is produced on the farm, pre-farm gate or on-farm standards.</p> <p>It is not about a specific crop production but the process through which production takes.</p>
Justification	Good Agricultural Practice (GAP) is based on the principals of risk prevention, risk analysis, sustainable agriculture (by means of Integrated

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

scaling up,	<p>suffering from complications than men in small scale holdings. This means that adaption of GAPs will increase the benefits of good health to the women and those who work more on the farm</p> <ul style="list-style-type: none"> • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as seeds than men. • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Proper application of GAP will lead to improved health of the various gender categories such as women • Use of the farmer field and business school strategy for effective training of farmer groups on sweetpotato and marketing • Opportunities for youths and women exists in sweetpotato production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Requires a lot of movement on the farm to maintain records and process verification which may be untenable by some VMGs who are elderly and disabled • VMGs have less access to agricultural information, technology and knowledge than men • High illiteracy level of the VMGs makes them unable to read the dissemination documents and other materials
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for youths and those recovering from drugs exists in sweetpotato production and marketing • Increased production will lead to increased consumption and utilization of sweetpotato hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	<ul style="list-style-type: none"> • Options for certification exist depending on whether it is a single holder certification or group compliance. • Compliance is a process and hence takes time and involves a process of continuous improvement. • No need for farm sophistication to adopt. • There is provision for taking corrective action for all noncompliance at time of assessment. • Requires continuous training and exposure to better systems
F: Status of TIMP readiness (1. Ready for upselling; 2. Ready for upscaling Requires validation; 3. Requires further research	
G: Contacts	
Contacts	Officer in Charge KALRO – PTC, Centre Directors; KALRO FCRI Njoro and KALRO West Pokot; Director General KALRO.
Lead organization/scientists	KALRO: Ndung’u J., Nyaga A., Wayua F., Wasilwa, L and Kirigua, V.
Partner organizations and their roles	MoALFC, AFA, FPEAK, PCPB, AAK, KEPHIS, County governments, NGOs, Universities

2.4 AGRONOMIC MANAGEMENT PRACTICES

2.4.1. Land preparation

TIMP Name	<p style="text-align: center;">Land preparation</p> 
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Land preparation
What is it? (TIMP description)	Land preparation is done by ploughing or digging up the land to a depth of about 20 cm and harrowing to pulverize the soil. Different methods viz. mound method, ridge and furrow method, bed method and flat method are practiced in sweetpotato cultivation in different localities of the country. However, it is preferable to plant sweetpotato on mounds especially in areas experiencing problems of drainage. In sloppy lands, ridge and furrow system is recommended for the control of soil erosion. Although the difference in yield between ridge and mound seedbed is small, research has been demonstrated that ridges give much higher income than mounds, simply because making ridges requires less labour. Ploughing using oxen or tractor is also possible when ridges are chosen. However, mounds are better in flat areas that are infested with mole root rats.
Justification	Good land preparation enhances weed control, aeration and mixing of organic matter with the soil. Adequate land preparation coupled with mound/ridge preparation also ensure increased water infiltration prevent competition from weeds that would otherwise result in significant yield losses thus multiple plowing prior to planting is also weed control measures. Also, the better soil aeration permitted by mounds/ridges and less tendency for soil compaction due to adequate preparation result in higher yields being recorded.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program”

	<ul style="list-style-type: none"> • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Awareness of challenges of poor land preparation in the field. • Timely ploughing of the land for proper weed control, soil aeration and mixing of organic matter with the soil. • The need for proper ploughing techniques for uniformity of plants in the field.
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya, Nyanza, Central Rift and Lower Eastern Counties
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	Low access to appropriate machinery and equipment.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main input cost is the labour for <i>land</i> preparation. The cost will depend on the land size, labor costs and the landscape terrain/slope /soil type/tractor driven plough however basic cost ranges from KES 3000 to 4,000 per acre
Estimated returns	Unknown but contribute towards increased yield along with other agronomical practices jointly; but on average KES. 150,000 per acre
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth have less access to farm implements such as pangas, jembes and tractors • Women and youth may also have limited access to finances to buy the required inputs such as quality cuttings. • Women and youth may have less access to credit than men • Women and youth may have less access to labour than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles

	<p>e.g. domestic</p> <ul style="list-style-type: none"> • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youths exists in transportation of the produce • Cash generated from sweetpotato production by the various gender categories can be ploughed back in other agricultural enterprises such as other crops or livestock farming. • Opportunities for youths and women exists in sweetpotato production, and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as quality sweetpotato vines than men • VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for women and other VMGs in cultivation of sweetpotato • Increased production will lead to increased consumption and utilization of sweetpotatos and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Sweetpotato Brochures, Fliers, Modules and Manuals
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-NPBRC Njoro, P.O. Private Bag 20107, NJORO
Lead organization/scientists	KALRO-Njoro - J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

2.4.2. Sourcing and selection of vines

<p>TIMP Name</p>  <p>Sweetpotato vine/cutting (25-30 cm)</p>	 <p>Healthy sweetpotato plant</p>
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Use of clean planting materials


<p>What is it? (TIMP description)</p>	<p>Sourcing and selection of vines: This involves the identification of the source of clean cuttings, and selecting healthy vines for harvesting for this purpose. Before picking the vines, the source needs to be verified to confirm that the vines selected are healthy by looking to see that the vines are: (i) free from both pest and disease infestation by checking for obvious symptoms including eggs, larvae and even adult pests, dark spots on the foliage, folded, curled or shriveled leaves. (ii) still fresh and of desired vine length (20–30cm) Shorter than 25 cm cuttings give lower yields and (iii) also the field is suitably and readily prepared before cutting the vines are harvested to ensure planting within 2–3 days after cutting is done to avoid vine deterioration. Planting materials can be sourced from research institutions, commercial seed producers or trained seed multipliers located in the counties.</p> <p>Preparation of planting materials: The selected planting material should be ‘clean’, free of insects, soil pests, and any symptoms of viruses or fungal diseases. The apical (tip) portion of the vine is recommended for planting as this portion is likely to carry less sweetpotato weevils and disease pathogens, and it establishes faster giving higher yields. The leaves are stripped from the lower portions of the vines, bundle the vines, wrap them in a wet cloth or sack and keep in a cool, shady place away from wind before planting.</p>
<p>Justification</p>	<p>Knowledge on how a healthy planting material looks like and how to select one is of paramount importance in clean sweetpotato establishment. Also knowing which part of the plant to source cuttings from is crucial. Select planting material from a clean, healthy, vigorous-looking plant, which less than 3 months old. Vine cuttings from such a crop produce a vigorous crop and better yield, whereas vines cut from an old crop (4–6 months) produce a less vigorous crop and poor yield. This is because as the crop approaches maturity, food stored in stems (vines) is channeled to the enlarging storage roots.</p> <p>The best planting material is the stem (vine) tip - the top 30 cm of the vine, when planting material is abundant. This part most easily recovers from cutting and planting “shock” and it grows faster than the lower parts of the vine. In addition, the tip is more likely to be free of sweetpotato weevil and stem borer eggs. The middle parts of the vine may also be used if there is a shortage of planting material. Avoid, as much as possible, the basal (lower) parts of the vine as these may have eggs, larvae or adult weevils inside.</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Farmers</p>
<p>Approaches used in dissemination</p>	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
<p>Critical/essential factors for</p>	<ul style="list-style-type: none"> • Awareness of challenges of sourcing clean planting materials.

successful promotion	<ul style="list-style-type: none"> • Timely availability of cuttings • The need for obtaining uniform cuttings, from either the tips or middle parts of the vines younger than 3 months.
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	-
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Stakeholders' willingness to cooperate in the dissemination process
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main input cost is the cost of the cuttings. The cost will depend on the land size, however basic cost ranges from ksh 3000 to 4,000 per acre
Estimated returns	Unknown but contribute towards increased yield along with other agronomical practices jointly; but on average KES. 150,000 per acre
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth have less access to farm implements such as pangas, jembes and tractors • Women and youth may also have limited access to finances to buy the required inputs such as quality cuttings. • Women and youth may have less access to credit than men • Women and youth may have less access to labour than men • The technology may not be adopted if the gender targeted especially women is overburdened • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have less access to agricultural information, technology and knowledge than men

Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youths exists in transportation of the vines to the end users • Opportunities for youths and women exists in sweetpotato production, and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as quality sweetpotato vines than men • VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for women and other VMGs in cultivation of sweetpotato • Increased production will lead to increased consumption and utilization of sweetpotatoes hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Sweetpotato Brochures, Fliers, Modules and Manuals
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-NPBRC Njoro, P.O. Private Bag 20107, NJORO
Lead organization/scientists	KALRO-Njoro - J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

2.4.3. PLANTING (a) Methods of planting/ Placement of vines in the soil


TIMP Name	PLANTING: (a) Methods of planting/ Placement of vines in the soil
 <p>Sweetpotato planted on mounds</p>	 <p>Single row</p>

	 <p style="text-align: center;">Double row</p>
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Proper planting/ placement of vines in the soil
What is it? (TIMP description)	<p>Refer to the various methods of establishing a sweetpotato crop – sweetpotato is mostly grown on mounds and ridges of varying sizes, but rarely on the flat land. Planting on ridges on hilly or sloping areas to control soil erosion. Mounds are better in flat areas that are infested with moles and/or rats. The planting operation involves pushing the lower parts of the vine cuttings into the soil so that they are nearly horizontal. About 20 cm or two thirds of the cutting should lie beneath the soil surface. Ridges are made 1.0 m apart (i.e. centre of the ridge to the next). For root production optimum root yields are obtained when vines are planted on single rows at the middle of the ridge at 30 cm between plants within the row. Double rows may be used though this is recommended for seed production where vines are planted on left and right position of the ridges at 30 cm between plants within rows and 50-60 cm between rows on ridges spaced at 100 cm.</p>
Justification	Knowledge on method of planting and when and where to use a particular method has a bearing on the final productivity of the sweetpotato crop.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Awareness of challenges of various methods of planting sweetpotato.
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the

	<p>farmers.</p> <ul style="list-style-type: none"> • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	Western Kenya, Nyanza and Central Rift Counties
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	Change of mindset from the traditional planting methods to the recommended practices by farmers
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main input cost is the labour for preparation. of mounds/ridges The cost will depend on the land size, labour costs and the landscape terrain/slope /soil type/tractor driven plough however basic cost ranges from ksh 3000 to 4,000 per acre
Estimated returns	Unknown but contribute towards increased yield along with other agronomical practices jointly; but on average KES. 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as quality cuttings than men. • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youths exists in transportation of the produce • Opportunities for youths and women exists in sweetpotato production, and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as quality sweetpotato cuttings than men • VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for women and other VMGs in cultivation of sweetpotato • Increased production will lead to increased consumption and utilization of sweetpotatoes hence improved health of VMGs

E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Sweetpotato Brochures, Fliers, Modules and Manuals
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-NPBRC Njoro, P.O. Private Bag 20107, NJORO
Lead organization/scientists	KALRO-Njoro -
Partner organizations	MoALFC, Seed and chemical companies, Universities

2.4.4. PLANTING: (b) Crop Spacing/Seed Rate

TIMP Name	PLANTING: (b) Crop Spacing/Seed Rate 
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Plant Spacing
What is it? (TIMP description)	It is a management practice where the distance from one plant mound to another and from one ridge to another ridge, and within the ridge, from one plant to another are determined respectively. It is aimed at attaining optimum plant population per given area. The recommendation is that a mound should be 100 cm (3ft) wide and 60 cm (2ft) high; the distance between mounds should be 1 m (3ft). Ridges should also be 100 cm (3ft) apart and 60 cm (2ft) wide. Production of optimum yields of sweetpotato through correct spacing management where the optimum root yields are obtained when vines are planted on single rows at the middle of the ridges that are spaced at 30 cm between plants within the row. This is synonymous with seed rate and it addresses the optimum number of plants that give optimum yield of sweetpotato in a given area. For sweetpotato the recommended number is 33,300 vines per ha (13,500 per acre). This means one gunny bag (90 kg) each carrying approximately 1000 vines, implying that 13 bags – 15 bags are required for an acre. (When mounds are used at a spacing of 1 m x 1 m between mounds, 30,000 cuttings are required per hectare if 3 cuttings per mound are used).
Justification	Improper spacing management practices have contributed to low yields due to low/high crop density. Also, challenges of field pests and diseases are greatly a result of too bushy crop due to over-population. Or, the crop is too sparse that weeds become a menace.

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima programme” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	Low uptake before the farmers see results
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFBS
Lessons learnt in upscaling, if any	
Social, environmental, policy and market conditions necessary for development and upscaling	Opportunities for increased yields due to reduced nutrient competition
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 2,000 per acre
Estimated returns	150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as quality cuttings than men. • Women and youth may also have limited access to farm implements required to perform the operation • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youths exists in transportation of the produce

	<ul style="list-style-type: none"> • Opportunities for youths and women exists in sweetpotato production, and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as quality sweetpotato cuttings than men • VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for women and other VMGs in cultivation of sweetpotato • Increased production will lead to increased consumption and utilization of sweetpotatoes hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	Sweetpotato Brochures, Fliers, Modules and Manuals
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-NPBRC Njoro, P.O. Private Bag 20107, NJORO
Lead organization/scientists	KALRO-Njoro - J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities

2.4.5. Fertilizer/manure application

TIMP Name	Fertilizer/Manure application
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor soils
What is it? (TIMP description)	It is a management practice where addition of nutrients to the soil is made to correct any deficiency. It is aimed at attaining optimum yield per given area. Fertilizer application should be informed by the soil analysis results. Normally sweetpotato does not require fertilizer application in most of the areas. However, in extremely poor soils a farmer may apply compound fertilizer e.g. NPK 17:17:17 at a 100 Kg per Ha in two splits, one at planting and the other after 2 weeks. Excessive nitrogen or planting in very fertile soils should be avoided since this encourages vegetative growth at the expense of tuberous root development. In poor soils farm yard manure can also be used and should be spread evenly over the bed just before ridging or mounding is done.
Justification	Poor soil fertility has contributed to low yields of sweetpotato in areas where soils are depleted.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in	<ul style="list-style-type: none"> • On-farm demonstration

dissemination	<ul style="list-style-type: none"> • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima programme” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	Low uptake before the farmers see results
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up the management practice at grass root level, FFS
Lessons learnt in upscaling, if any	
Social, environmental, policy and market conditions necessary for development and upscaling	Opportunities for increased yields due to improved nutrient availability to the plants
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 2,000 per acre
Estimated returns	150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as quality cuttings than men. • Women and youth may also have limited access to farm implements required to perform the operation • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for youths exists in transportation of the produce • Opportunities for youths and women exists in sweetpotato production, and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required

	<p>inputs such as quality sweetpotato cuttings than men</p> <ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for women and other VMGs in cultivation of sweetpotato • Youth and other VMGs may benefit by providing labour required during fertilizer/manure application in the sweetpotato farms
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Sweetpotato Brochures, Fliers, Modules and Manuals
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-NPBRC Njoro, P.O. Private Bag 20107, NJORO
Lead organization/scientists	KALRO-Njoro - J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwozony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, Universities


2.4.6. Crop rotation

TIMP Name	Crop rotation
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low watermelon yields
What is it? (TIMP description)	Crop rotation is the technique of planting crops in a different area of the farm so that no single crop will be planted in the same place two or more years in a row. It's a practice of growing different types of crops (or none at all) in the same area over a sequence of seasons. A basic principle of crop rotation is to avoid growing the same crop for consecutive years and principles of crop production is interchanging of tap root crops with fibrous root crops, leguminous with non-leguminous, avoidance of crop of same family following one another in order to avoid build up pest and diseases. Also different types of plants require different types of nutrients from the soil. Sweetpotato does well following cereals or legumes, but it is not recommended for it to follow other root and tuber crops, particularly cassava, due to their similar nutrient requirements.
Justification	Changing crops routinely allows the land to remain fertile, since not all of the same nutrients are being used each season. For example, planting a legume, such as soybeans, helps to replenish necessary nitrogen in the soil. Crop rotation can help to manage soil fertility, reduce soil erosion, improve soil health and increase nutrients availability to plants. Crop rotation also helps to reduce the build - up of diseases, such as viruses, and pests such as weevils and nematodes and, weed populations in sweetpotato
Region promoted	
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Producers (farmers), extension agencies
Approaches used in dissemination	Use of service providers, Tot, demonstrations, farmers tour
Critical/essential factors for successful promotion	Farmers tour for knowledge from other successful farmers
Partners/stakeholders for scaling up	NGOs, extension, private service providers
C: Current situation and future scaling up	
Counties where already promoted, if any	Migori, Nakuru, Trans-Nzoia, Bomet
Counties where TIMPs can be up-scaled	Migori County
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low publicity • Limited support from the county government and national government • Inadequate technology and research inputs
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Enhanced publicity • Enhanced support from national and county government
Lessons learnt in upscaling	Availability of Cost benefit information that can attract farmers to engage into the activities.
Social, environmental, policy and market conditions necessary	-
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Unknown
Estimated returns	Its yet to be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land, quality sweetpotato cuttings and credit • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in performing the farm operation • Opportunities for youths exist in transporting the produce
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seed sweetpotato cuttings • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Crop rotation places emphasis on the importance of using available land space to grow diverse food crops, increase biodiversity, manage pests thus the practice is economically viable for VMGs. • Opportunities exist for youth exists in transporting the produce
E: Case studies/profiles of success stories	

Success stories	
Application guidelines for users	Sweetpotato Brochures, Fliers, Modules And Manuals
F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-NPBRC Njoro, P.O. Private Bag 20107, NJORO
Lead organization/scientists	KALRO-Njoro - J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwosony, P Yegon and A Mulwa
Partner organizations	MoALFC, Seed and chemical companies, NGOs, Universities

2.4.7. Weed control

TIMP Name	Weed control  Hand pulling of weeds
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Weed infestation
What is it? (TIMP description)	Weeds cause economic loss in sweetpotato by providing competition for nutrients, water and light, and by harbouring insect pests and diseases. Weed roots of certain spear grasses species can even pierce and damage the sweetpotato roots creating imprint/defects that reduces quality of roots. Weed foliage may prevent proper contact of fungicides and insecticides with watermelon foliage and fruit
Justification	If weeds are not controlled during plant establishment and within the first two months after planting, they compete with the sweetpotato plants for nutrients, water and light and, may harbour insect pests and diseases. Mechanical removal weeds is the most effective control for weeds where shallow cultivation between rows and utmost care is observed to avoid injury to the root system. Mulch also provides excellent weed growth over the plant rows.
Region promoted	
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers (farmers), extension agencies
Approaches used in dissemination	Use of service providers, Tot, demonstrations, farmers tour

Critical/essential factors for successful promotion	Farmers tour for knowledge from other successful farmers
Partners/stakeholders for scaling up	NGOs, extension, private service providers
C: Current situation and future scaling up	
Counties where already promoted, if any	Nakuru, Migori, Nakuru, Trans-Nzoia
Counties where TIMPs can be up-scaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low publicity • Limited support from the county government and national government • Inadequate technology and research inputs
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Enhanced publicity • Enhanced support from national and county government
Lessons learnt in upscaling	Cost benefit information should be available to farmers.
Social, environmental, policy and market conditions necessary	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES. 4,000 per acre
Estimated returns	To be established through further research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crop production activities such as weeding hence this may increase their work burden • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in weeding
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seed • 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	Opportunities exist for those recovering from drugs in weeding
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Water melon brochures, fliers, modules and manuals
F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-NPBRC Njoro, P.O. Private Bag 20107, NJORO
Lead organization/scientists	KALRO-Njoro - J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwoony, P Yegon and A Mulwa

Partner organizations	MoALFC, Seed and chemical companies, Universities
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2.4.8. Intercropping


TIMP Name	Intercropping
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Weed control
What is it? (TIMP description)	Intercropping refers to the growing of two or more crops on the same land at the same time. Sweetpotato fits well in most of the cropping systems: it can be done as relay crop just before harvesting of cereals. Sweetpotato is easily intercropped when planted on ridges with crops such as beans, sugarcane and bananas. Intercropping with short crops or legumes is recommended and where intercropping with tall crops is done, care should be taken to adjust plant population of the intercrop to minimize the competition effects on the main crop. In such case it is important to modify the planting pattern to minimize shading especially when intercropped with taller crops. It is common to find sweetpotato relayed with sweetpotato. Sweetpotato can also be used as a cover crop or planted on terraces; this way it helps in moisture conservation and minimizes soil erosion. Intercropping of sweetpotato is easier when it is grown on ridges. As with all intercropping, the cropping pattern should try and minimise the competition for light and nutrients between the two or more crops being intercropped. If intercropping sweetpotato with beans, soybeans or peas, sweetpotato can be planted along the ridge and a row of beans on either side of the ridge.
Justification	Intercropping, in addition to improving crop and food diversity, can also: improve labour efficiency; increase soil fertility if nitrogen fixing intercrops are used; and reduce weed growth.
Region promoted	Bomet, Migori and Nakuru
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers (farmers), extension agencies
Approaches used in dissemination	Use of service providers, Tot, demonstrations, farmers tour
Critical/essential factors for successful promotion	Farmers tour for knowledge from other successful farmers
Partners/stakeholders for scaling up	NGOs, extension, private service providers
C: Current situation and future scaling up	
Counties where already promoted, if any	Bomet, Migori and Nakuru
Counties where TIMPs can be up-scaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low publicity • Limited support from the county government and national government • Inadequate technology and research inputs

Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Enhanced publicity • Enhanced support from national and county government
Lessons learnt in upscaling	Availability of Cost benefit information that can attract farmers to engage into the activities.
Social, environmental, policy and market conditions necessary	-
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KEs. 4,000 per acre
Estimated returns	To be established through further research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to land for sweetpotato cultivation than men • Women and youths have less access to funds required for farm operations • Women have less access to agricultural information, technology and knowledge than men • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to credit to purchase the required inputs than men
Gender related opportunities	<ul style="list-style-type: none"> • The technology is acceptable and easy to upscale by all the various gender categories including women and the youth • The FFBS strategy that is being used for effective training in sweetpotato production is inclusive of the various gender categories • Opportunities for youths and women exists in sweetpotato production, transportation and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as seeds than men • VMGs have less access to agricultural information, technology and knowledge than men • The laborious production practices may not be friendly to the VMGs who are differently abled • VMGs may have less access to markets than men
VMG related opportunities	<ul style="list-style-type: none"> • Sweetpotato is nutritious and well adopted in the country hence will act as a food security crop for the VMGs • The technology is acceptable and easy to upscale by all the various gender categories including the VMGs • Increased production will lead to increased consumption and utilization hence improved health of VMGs • The FFBS strategy that is being used for effective training in sweetpotato production is inclusive of the VMGs • Opportunities for youths and women exists in sweetpotato production transportation and marketing
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	sweetpotato brochures, fliers, modules and manuals

F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research		Ready for upscaling
G: Contacts		
Contacts	Centre Director KALRO-Njoro, P.O. Private Bag 20107, Njoro	
Lead organization/scientists	KALRO-Njoro - J Malinga, B Kivuva, J Ndungu, D Lelgut, A Gichangi, R Chebwozony, P Yegon and A Mulwa	
Partner organizations	MoALFC, Seed and chemical companies, Universities	

2.5 SOIL FERTILITY MANAGEMENT

2.5.1. Integrated Manure Management (IMM)

TIMP Name	Integrated Manure Management (IMM)	
	 <p style="text-align: center;">Fully decomposed organic manure</p>	
Category (i.e. technology, innovation or management practice)	Complementary technology	
A: Description of the technology, innovation or management practice		
Problem addressed	<ul style="list-style-type: none"> • Land degradation characterized by the declining soil fertility, low yields, increased soil moisture stress, increased soil erosion and poor soil health • Poor manure management and handling leading to increased Green House Gases (GHG) emissions 	
What is it? (TIMP description)	Integrated Manure Management (IMM) is the optimal, site-specific handling of livestock manure from collection, through treatment and storage up to application to crops.	
Justification	<p>The decline in soil fertility in smallholder system is a major factor inhibiting agricultural development on farms. It is estimated that soils are depleted at annual rate of 22kg/ha for nitrogen, 2.5kg/ha for phosphorous, and 15kg/ha for potassium. Manure plays an essential role in the nutrient cycle where crops grow on land to feed livestock, which in return feeds the land with their manure.</p> <p>Recycling the nutrients (macro and micro) in manure reduces the need for additional fertilizer purchase. In general, adding manure to soils enhances soil fertility and soil health that leads to increased agricultural productivity, improved soil structure, increases moisture and nutrient retention and biodiversity.</p> <p>Given the acute poverty and limited access to mineral fertilizers, manure has the potential of providing the limiting nutrients and improving the soil health.</p>	
B: Assessment of dissemination and scaling up/out approaches		

Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • Open and field days • Exchange visits • Demonstration farms; on station and on field • FFBS • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Training on feeding, management and use of manure • Dissemination approach used to reach target farmers • Model demonstration plots using cereal crops
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County governments, Provide extension services, farmer mobilization and policy formulation • ILRI (International Livestock Research Institute), technical backstopping • NGOs – micro financing services
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Bungoma, Kakamega and Kisumu
Counties where TIMP will be promoted	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of model demonstration farms • Cultural challenges -Lack of interest by pastoral communities • Lack of continuity in training of extension and farmers in the skill for manure management • Lack of proper mobilization mechanism for reaching many farmers
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establishment of many demonstration plot by counties • Capacity building of pastoral communities on manure management and its benefit • Continuous capacity building of demonstration farmers and extension workers • Use of approaches to mobilize farmer to attend demonstration forums
Lessons learnt if any	<ul style="list-style-type: none"> • Proper use of manures improves soil fertility • Use of manures enhances crop productivity • Skills in manure preparation, storage and application
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Applying manure to soils saves on purchase of inorganic fertilizer, increases crop yield and saves water. • Propagation of invasive species when the seed is ingested by the animal and passed to crop field • Manure can harbor pathogens which can cause disease outbreaks to livestock • Contamination of water sources by leaching of nutrients • Organic manures when poorly handled increase GHG emissions. However, IMM provides practices that are able to minimize GHG emissions.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Proper handling of manure needs labour for collecting the manure, building a compost heap, maintaining it and finally transporting and applying it field which take a lot of effort and time • Using locally available manure/composts saves on purchase of inorganic fertilizer.
Estimated returns	<ul style="list-style-type: none"> • Returns dependent on crop and crop varieties in the value chain where IMM is practiced

Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crop production activities such as weeding hence the IMM may increase their work burden • Women and youth have limited access to productive resources such as land, quality sweetpotato cuttings and credit • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Employment opportunities exist for and youth in IMM operations
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality sweetpotato cuttings • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness • It is labour intensive in terms of handling and application hence may disadvantage VMGs
VMG related opportunities	Opportunities exist for unemployed youth in transporting the produce
E: Case studies/profiles of success stories	
Success stories	Farmers who adopt manure management practice have reported improved soil health and increased crop yield, and sustainable source of income
Application guidelines for users	<ul style="list-style-type: none"> • The guideline focuses on the following areas: • Animal feeds • Livestock housing and manure collection • Manure storage to preserve nutrient and avoid loses • Manure treatment for ease of transport and application in the field • Timing of application for maximum utilization by the crop • Anaerobic digestion for biogas production • Regular analysis of manure to ascertain the quality • Manure/Composts take a long time to cure, hence need good planning prior to use
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	
Requires validation	
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO, S. Kimani, E.Mutuma, D. Kamau, M. Okoti, J. Wamuongo, A.O. Esilaba, F.M.Wandera
Partner organizations	County government, Private Public Partnerships

Research gaps

- Promote IMM complementary technology in counties that have not practiced it.
- Conduct nutrient budget study on selected farms utilizing manures (including composts) in each of the 24 Counties.

2.5.2. Integrated Soil Fertility Management (ISFM)

TIMP name	Integrated Soil Fertility Management (ISFM)
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Category (i.e. technology, innovation or management practice)	Complementary technology
A: Description of the technology, innovation or management practice	
Problem addressed	Declining soil fertility, low organic matter, restoring soil structure and conserving the limited available moisture in crop production.
What is it? (TIMP description)	A set of soil fertility management practices that include the use of fertilizers, locally available organic inputs and improved seed combined to adapt practices to local conditions. It places emphasis on the importance of using often scarce resources like fertilizer and organic inputs efficiently through techniques such as fertilizer banding (field application of fertilizer directly in area of root-zone to increase the potential for uptake) and micro dosing (applying small quantities of fertilizer with the seed at planting time and a few weeks after emergence).
Justification	<p>Soils within the farming systems are heterogeneous due to spatial variability in soil fertility. These inherent differences arise from the parent material from which the soil has evolved, and the position in the landscape that influences how soil develops.</p> <p>A large proportion of soils in the KCSAP target project counties are derived from some of the oldest land surfaces which, due to weathering and cropping, have low nutrients. Where younger, volcanic soils occur these are inherently richer in nutrients, but may have other soil fertility problems such as fixation of some critical nutrients such as phosphorus. Past management of the soils also has a major influence on soil fertility which in turn influences productivity.</p> <p>These challenges call for an integrated soil fertility management (ISFM) approach that combines appropriate interventions on soil management that include fertilizer use and crop agronomy. ISFM therefore aims to optimize agronomic use efficiency of the applied nutrients for improved crop productivity.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Training in workshops • On-farm visits • Farmer field and business schools (FFBS) • On-farm demonstrations (during FFS) • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of affordable and quality manure, fertilizers and clean planting materials • Take into account variability between farms, in terms of farming goals and objectives, size, labour availability, ownership of livestock, importance of off-farm income; and • Take into account amount of production resources (i.e. land, money, labour, crop residues) that different farming families are able to invest in.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension services; Provide link with farmers. • Community farmer groups; play coordination role for ease in problem identification and dissemination.
C: Current situation and future scaling up	

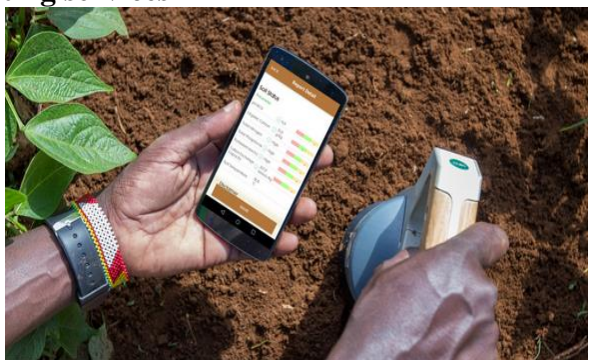
Counties where already promoted if any	Homabay, Kisii, Bungoma and Uasin Gishu
Counties where TIMP will be promoted	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mindset in some regions/cultures that organic manures cannot be applied on crops • Misconceptions that chemical fertilizer damage the soils
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness trainings on role of organic manures in crop cultivation • Training and awareness creation on the usefulness of fertilizer applications to clear the misconceptions about fertilizers
Lessons learnt if any	For ISFM to succeed, good germplasm/seed/seedlings is required since farmers tend to re-use previous planted materials.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Practice is socially acceptable • Environmentally friendly • Increased productivity will provide supply to the markets • Supporting frameworks/policies are available
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	This is a technically demanding technology and high cost in areas where application of ISFM is non-responsive
Estimated returns	Farmers who have adopted ISFM technologies have more than doubled their agricultural productivity and increased their farm-level incomes by 20 to 50 percent
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • It is labour intensive hence may not be adopted by women who are already overburdened • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as sweetpotato cuttings than men. • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunity exist for youths in transportation of the produce • The technology is acceptable and easy to upscale by both males and female gender
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs are physically disadvantaged for a practice that seeks to incorporate manures, etc in the farm • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as seeds than men • VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • Affirmative action in various areas as for instance in the provision of finances for farming to VMGs • Increased production will lead to increased consumption and utilization of sweetpotato and hence improved health of VMGs
E: Case studies/profiles of success stories	

Success stories	<ul style="list-style-type: none"> ISFM successes have been reported in sorghum and millet value chains in Machakos where productivity have been improved
Application guidelines for users	<ul style="list-style-type: none"> Always use well-adapted, disease- and pest-resistant germplasm/seed to make efficient use of available nutrients. Ensure that good agronomic practices are upheld For sustainability, lone use of inorganic or organic materials should be avoided.
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	Requires validation
G: Contacts	
Contacts	Centre Director, KALRO Kabete
Lead organization/scientists	KALRO; E. Gikonyo, D. Kamau, A. O. Esilaba, J. Ndufa, F.M.Wandera
Partner organizations	County governments, Kenya Forestry Research Institute (KEFRI)

Research Gaps

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

2.5.3. Rapid soil testing services

TIMP Name	<p>Rapid soil testing services</p>  <p>Handheld scanner and mobile app monitoring soil nutrients</p>
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Conventional methods for soil testing are not cheap to farmers, results take long and not are reproducible. The methods have not provided solutions for paired soil and leaf testing to determine health of soil and crop simultaneously. Current methods do not provide a framework for large scale assessment of geo-referenced sampled points using standardized protocols. Limited access to soil testing services (centralized soil testing laboratories and cost).
What is it? (TIMP description)	<p>This is a dry method for soil testing using simplicity of light—the interaction of electromagnetic radiation with matter to characterize biochemical composition of a soil and/or plant tissue.</p> <p>It requires partners involved (ICRAF, iSDA and AgroCares) to work closely with KALRO and County agricultural officers to sensitize farmers to embrace the testing method.</p>

Justification	Soil testing is the basis for good fertilizer management that maintains the productivity of soil and improves the quality of crops. It promotes more efficient fertilizer use and prevents environmental pollution from excess fertilizer application, and cost efficiency. However, limited access to soil testing services is depriving the farmers' ability to make informed decisions with regard to soil management and fertilizer use.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension officers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Farmer visits • Training in workshops • FFBS • Agriculture Innovation Platforms • Publicity campaigns done at County levels.
Critical/essential factors for successful promotion.	<ul style="list-style-type: none"> • Availability of the necessary equipment for rapid on the spot soil testing. • Established rapport between farmers and the technical personnel involved in soil testing. • Adequate qualified staff to cover the large number of samples from the target 24 counties before the planting season begins. • A well-designed storage system for keeping information obtained at farm level including (GPS readings, physical description of the locations, raw measured scanned data and fertilizer recommendation according to crop type suitability). Availability a van to mount the equipment. • Farmers must understand, trust, and be willing to act upon the information provided
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension services; providing the link to farmers given that agriculture is devolved. • Soil Cares; Provides soil scanners technology and capacity building in collaboration with KALRO and ICRAF, • ICRAF and iSDA tests and validates the recommendation obtained in collaboration with SoilCares and KALRO. • Fertilizer companies; To provide fertilizer blends according to soil health status • Agro dealers to stock required fertilizers that is readily available to farmers
C: Current situation and future scaling up	
Counties where already promoted	Kiambu, Murang'a, Siaya and Kakamega
Counties where TIMP will be up scaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • It requires continuous updating methods to improve recommendations. • Lack of awareness on the importance of regular testing of soil quality
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation, intensive farmer field training (capacity building) • Make the whole process cost efficient. Use of scanners (spectroscopy) and less wet chemistry analysis. • Automated pipelines for updating existing recommendation methods.
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Timely affordable soil information will guide on fertilizer use. Farmers have reported frustration when they apply the wrong fertilizers and see no results because they did not take the first step to understand what the soil demand in terms of macro, micro nutrients and trace elements like

	Zinc and Sulphur.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Socially acceptable-brings income, increases food production, nutrition security and family cohesion. • Environmentally friendly-farmers only apply the required amounts of fertilizers. No excess nutrients to contaminate ground and surface water. • Increased productivity will provide supply to the markets • Supporting frameworks/policies are available.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Soil testing equipment and consumables, sampling and packaging materials, personnel. The actual costs will be determined upon consultation. • Shipping selected soil and plant materials for further testing and results verification in a certified lab.
Estimated returns	<ul style="list-style-type: none"> • Dependent on the enterprise adopting the service, but estimated at least 30% of current returns and no doubt will be making agronomy great again.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • It is labour intensive hence may not be adopted by women who are already overburdened • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as seeds than men. • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunity exist for youth in soil sampling and testing in the local community • Cash generated from sweetpotato production by the various gender categories can be ploughed back in other agricultural enterprises such as other crops or livestock farming. • The technology is acceptable and easy to upscale by both males and female gender • Opportunities for youths and women exists in sweetpotatos production , and marketing
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as seeds than men • Women have less access to agricultural information, technology and knowledge than men
VMG related opportunities	<ul style="list-style-type: none"> • This TIMP that will bring soil testing services nearer to this group of farmers and therefore is a saving and is expected to improve productivity • Increased production will lead to increased consumption and utilization of sweetpotato and hence ensuring food security of the VMGs
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • Has been tested used successfully by other organizations like ICRAF, Soil Cares and Kenya Sugar Research Foundation (KESREF). • It has been adopted at Kenya cane testing centre for checking maturity


	level and quality of sugarcane.
Application guidelines for users	<ul style="list-style-type: none"> • A handheld scanner to testing soils and crops in the field • Community soil sampling champions are identified and trained on good soil sampling procedures. • Soil and crop is analyzed and the results including fertilizer recommendation generated on site.
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO secretariat
Lead organization/scientists	KALRO; C. Kibunja, A. Sila, D. Kamau, A.O. Esilaba, F.M. Wandera
Partner organizations	County governments in the 24 counties, Soil Cares, ICRAF and iSDA

Research gaps:

- Testing paired soil and crop samples to determine nutrients in the soil and what is available to plant.
- Determine nutrient deficiency and make recommendation for the type of fertilizer to use and at what rate.
- Developing a fertilizer recommendation system with options for new blends.
- Working with fertilizer companies to produce fertilizer blends packaged in smaller quantities per farmer needs.
- Using scanners at farm level to undertake fertilizer quality analysis, e.g. quantitative and qualitative analysis, major and trace elemental analysis, and chemical and physical analysis.
- Updating existing soil maps with newly acquired soil data to provide current soil fertility status in the country.

2.6 SOIL AND WATER MANAGEMENT

2.6.1. Contour bunds

TIMP Name	Contour bunds  <p style="text-align: center;">Contour band</p>
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	The risk of soil erosion and increased run off from torrential rains, low soil water retention capacity of soils in dryland ecosystems
What is it? (TIMP description)	Contour bunding involves laying points of equal elevation of stone or soil along the contour of a sloping field followed by constructing a bund or barrier along the contour. Making furrows parallel to the contours ensures that rainfall and runoff are spread evenly over a field. The earthen bund is formed by excavating a channel and creating a small ridge on the downhill side. Thus, contour bunds resemble narrow channel terraces

	commonly referred to as “ <i>fanya chini</i> ” terraces. The technology is highly suitable for areas with unpredictable rains especially the drought-prone areas (ASALs).
Justification	The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs. Contour bunds resemble narrow channel terraces commonly referred to as “ <i>fanya chini</i> ” terraces. The aim of contour bunds and hedgerows is to concentrate moisture into the ridge and furrow area where the crops are planted by trapping run off water from the catchment area between them. This also decreases the risk of erosion. Plants with higher water requirements, such as peas or beans, can be planted on the higher side of the furrow whereas fruit crops requiring less water, such as sweetpotato, can be planted on the ridges. Construction of contour bunds is relatively simple and low-cost way to reduce soil degradation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Approaches to be used in the dissemination include: • On-farm demonstrations during farmer field schools • Training in workshops. • Extension information materials which will be distributed to farmers through farmer groups and the County extension service providers. • FFBS • Agriculture Innovation Platforms
Most effective approach	<ul style="list-style-type: none"> • Model farm demonstration
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct contour bunds. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Busia, Kisumu, Elgeyo Marakwet, Bungoma and Makueni
Counties where TIMP will be promoted	Migori
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Increased risk of soil erosion if contours are improperly laid out • Labour intensive and many farmers may find it difficult to implement at large scale • Land tenure systems – communal land ownership, or in places where individuals don’t have land title deeds
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate equipment for preparation of Contour for efficiency and increased output per man hour. • Training youthful farmers to be champions of Contour bunds construction at the Ward level/village level. • Training on site specific designs and construction of contour bunds • Fast-track land registration

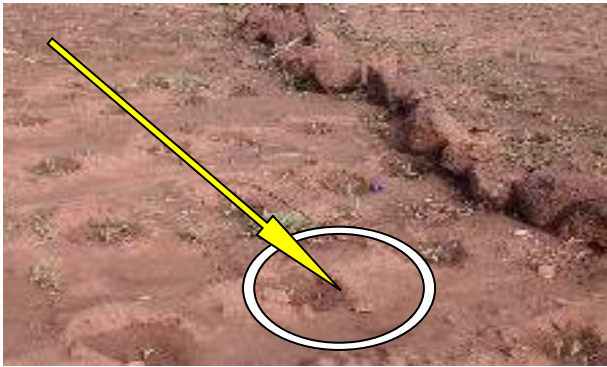
Lessons learnt, if any	<ul style="list-style-type: none"> • Terracing is popular due largely to the rapid benefits it gives in terms of improved crop performance. • Existence of well-developed self-help groups can lead to successful soil and water conservation activities. • Conducting well publicized campaigns has been found to add to the success of soil and water conservation. • Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low-cost technologies for soil and water conservation • Policies that support individual land tenure systems
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main input cost is the labour for <i>contour</i> preparation. The cost will depend on the land size and the landscape terrain/slope
Estimated returns	The returns depends on the value chain being addressed
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Ownership of or access to land may limit women in some regions • Making decisions on land use may limit women in some region where decision making is men dominated • Differing accessibility of the technology and information may disadvantage different gender • The technology is labour intensive hence may disadvantage women and members who cannot procure labour services • Differing accessibility of information between men and women because of gender norms that place access to new information and technologies in the hands of male heads will affect adoption and scaling up. • Ownership of or access to land and credit will affect adoption and scaling up.
Gender related opportunities	<ul style="list-style-type: none"> • Increased agricultural production will increase access to food and income among all gender. • Potential for employment creation - youthful male and women will provide labour during the implementation of the technology.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Limited of access to information may limit the VMG from technology access and use • Limited attendance during awareness and sensitization campaigns due to physical body challenges or insecurity challenges limits use of technologies. • The technology is labour intensive and may be difficult for the VMG to implement in the field. • The labour cost of adopting this technology might be out of reach for the VMGs thus affecting adoption and scaling up. • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs • Competing priorities and household decisions might hinder adoption and scaling up.
VMG related opportunities	<ul style="list-style-type: none"> • Application of contour ridge is expected to improve agriculture production thus, more food and income for the VGMs.
E: Case studies/profiles of success stories	
Success stories, if any	-

Application guidelines for users	Soil is excavated up-slope of the bund to a depth of 50 cm. Contour bunds should drain in one direction and can be manually or machine constructed. The length of a bund across a slope should be between 400 to 500 m. The height of a bund should be at least 25 cm and have an approximate spacing of 1-2 m. In arid areas, the distance between bunds can be increased to 5-10 m. Hedgerows grown to stabilize bunds should be spaced at 4 to 8 m across the slope.	
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	Ready for upscaling	Ready for upscaling
G: Contacts		
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI, Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org	
Lead organization/scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau and A.O. Esilaba, F.M.Wandera	
Partner organizations	County Government extension offices.	

Research gaps

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

2.6.2. Zai Pits

TIMP Name	Zai Pits	
		Zai pits combined with stone rows
Category (i.e. technology, innovation or management practice)	Management Practice	
A: Description of the technology, innovation or management practice		
Problem addressed	Unreliable water to sustain a crop as a result of high seasonal rainfall variability leading to total crop failures. Decreased yields leading to food insecurity.	
What is it? (TIMP description)	<i>Zai Pits</i> are small planting pits typically measuring 15-30 cm in width, 10-20 cm deep and spaced 60-80 cm. <i>Zai Pits</i> harvests and stores water for prolonged crop use. Farmers plant seeds into the pits after filling one to three handfuls of organic material such as manure, compost, or dry plant biomass. The technology is highly suitable for areas with unpredictable rains especially the drought-prone areas (ASALs).	
Justification	The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially	

	in the ASALs. <i>Zai Pits</i> technology has the potential to harvests and store rain water for prolonged crop use. This technology also contributes to improving the management of degraded lands, reducing soil erosion, vegetation loss and biodiversity as well as crop yield.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Approaches to be used in the dissemination include: • On-farm demonstrations during farmer field schools • Training in workshops. • Extension information materials which will be distributed to farmers through farmer groups, Agrovets and the County extension offices. • FFBS • Agriculture Innovation Platforms
Most effective approach	<ul style="list-style-type: none"> • Model farm demonstration
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct <i>Zai</i> pits. • Availability of affordable organic matter i.e. manure, compost.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension services –delivery of information inputs to farmers. • Community farmer groups – Provide on-farm demonstration plots to hold farmer field schools • NGOs – capacity building, policy support in soil and water conservation issues
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Migori
Challenge(s) in development and dissemination	The greatest challenge is that the technology is labour intensive and many farmers may find it difficult to implement at large scale.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate equipment for preparation of <i>Zai</i> pits for efficiency and increased output per man hour. • Training youthful farmers to be champions of <i>Zai</i> pits construction at the Ward level/village level.
Lessons learnt, if any	<ul style="list-style-type: none"> • The technology has huge potential to increase farmers’ resilience especially in ASALs. Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest in it to maximize yields.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforcement of policies on soil and water conservation at the County level • Creation of awareness on the importance of soil and water conservation • Provision of low-cost technologies for soil and water conservation • Policies that support individual land tenure systems • Provision of support in the establishment of the <i>Zai</i> pits
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main input cost is the labour for <i>Zai pit</i> preparation. It is estimated at KES 40 to 100 per <i>Zai Pit</i>


Estimated returns	To be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • It is labour intensive in terms of preparation and application hence may not be adopted by women who are already overburdened • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as seeds than men. • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunity exist for youth during implementation • The technology is acceptable and easy to upscale by both males and female gender
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • The technology involves carrying of heavy manure to the field during establishment which may be difficult for the physically weak VMGs. • VMGs may also have limited access to finances to buy the required inputs such as seeds than men • Women have less access to agricultural information, technology and knowledge than men • The technology is labour intensive and may be difficult for the VMG to implement in the field
VMG related opportunities	<ul style="list-style-type: none"> • Application of ZAI pits is expected to improve agriculture production thus, more food and income for the VMGs • Increased production will lead to increased consumption and utilization of sweetpotatos and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories, if any	<ul style="list-style-type: none"> • Two women groups in Kiliki, Matungulu sub-County of Machakos County through a representative Janet Ndunge reported having started using the <i>Zai pit</i> farming technology in 2013 after attending a farming workshop by the Institute for Culture and Ecology (ICE). “Ever since we started using <i>Zai pits</i>, we have seen an increase in our harvests as compared to the conventional methods of farming,” she said. • Farmers in Kathonzweni, Makueni County increased dug pits from 170 to 500 pits for crop production due to initially observed benefits. • Communities in ASALs have also rehabilitated degraded lands and increased production by many folds.
Application guidelines for users	<ul style="list-style-type: none"> • Zai pits are 5-15 cm deep, 15-50 cm wide and 80-100 cm apart. In dry areas the size of planting pits can be enlarged. Compost or manure is placed in the pits before planting to improve soil fertility. It is not necessary to follow the contour when constructing pits. • Compost or manure is placed in the pits before planting to improve soil fertility. It is not necessary to follow the contour when constructing pits. • The zai pits are during the dry season when labour constraints are minimal. Each pit is 20-30 cm wide, 10-30 cm deep, with the soil from the pit thrown downhill to form a crescent shaped dam. The spacing of the pits within a row, as well as the space between the rows of pits varies

	<p>between 60 and 100 cm.</p> <ul style="list-style-type: none"> At the beginning of the rains, 200-600 g of dung or compost (two handfuls of organic matter are approximately 300 g) are added to the pits. The organic matter is mixed, in the bottom of the hole, with approximately 5 cm soil. Each pit is then sown with 8-12 millet or sorghum seeds.
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Ketiem, J. Mwaura; D. Kamau and A.O. Esilaba, F.M.Wandera
Partner organizations	County Government extension offices.

Research gap

- Validation of the economic viability of the technology in counties where it has never been used.

2.6.3. Bench terraces


TIMP Name	<p>Bench terraces</p>  <p style="text-align: center;">Bench Terrace</p>
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	The risk of soil erosion and increased run off; low soil water retention capacity in most soils
What is it? (TIMP description)	<p>Bench terraces consist of a series of beds which are more or less level running across a slope at vertical intervals, supported by steep banks or risers (walls or bunds).</p> <p>The flat beds created by bench terraces enable the cultivation of crops on medium to steep slopes. The technology is highly suitable for Semi-arid to humid regions of rainfall, 700 mm or more; medium to steep slopes (12-47%) (Bench terraces are not recommended for slopes less than 12%); soil depth of greater than 50 cm; and areas with no gullies, nor stones.</p>
Justification	Agricultural production is threatened in many parts of the Kenya by soil erosion and limited soil moisture. Conservation of soil and moisture through construction of terraces has led to better and more reliable crop yields especially in the ASAL counties of Kenya.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Approaches to be used in the dissemination include: • On-farm demonstrations during farmer field schools • Training in workshops. • Extension information materials which will be distributed to farmers through farmer groups and the County extension service providers • FFBS • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct contour bunds. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Migori
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Increased risk of soil erosion if terraces are improperly laid out • Labour intensive during construction and maintenance and many farmers may find it difficult to implement at large scale • Land tenure systems – communal land ownership, or in places where individuals don't have land title deeds
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate equipment for preparation of Bench terrace for efficiency and increased output per man hour. • Training youthful farmers to be champions of making bench terraces construction at the Ward level/village level. • Training on site specific designs and construction of bench terraces • Fast track land registration
Lessons learnt, if any	<ul style="list-style-type: none"> • Terracing is popular due largely to the rapid benefits it gives in terms of improved crop performance. • Existence of well-developed self-help groups can lead to successful soil and water conservation activities. • Conducting well publicized campaigns has been found to add to the success of soil and water conservation. • Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low-cost technologies for soil and water conservation • Policies that support individual land tenure systems
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main input cost is the labour for <i>Bench terrace</i> preparation. The cost will depend on the land size, labor costs and the landscape terrain/slope
Estimated returns	The returns depend on the value chain being addressed

Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Bench terrance technology is labour intensive therefore may increase women work burden • Women have less access to agricultural information, technology and knowledge • Women and youth have limited access to productive resources such as land, quality seed and credit • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	Potential to create employment for youth through provision of the labour required
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities exist for youth exists in provision of labour
E: Case studies/profiles of success stories	
Success stories, if any	<ul style="list-style-type: none"> • Mukethe Mbithi is a member of the Kyungu Mwethya group in Machakos • "Before making the bench terraces we didn't have good harvests because the soil was eroded. When we put fertilizer on, the water washed. But when we made terraces the soil erosion stopped and we got good crops. So, I encourage other farmers especially in dry areas to try this new technology for their crops"
Application guidelines for users	<ul style="list-style-type: none"> • Terraces draining in one direction should be at least 100m or more. The length can be slightly increased in arid and semi-arid regions. The width of the bench (flat part) is determined by soil depth, crop requirements, and tools to be used for cultivation. • Optimum width of terrace benches ranges from 2.5 to 5 m for manually constructed ones and from 3.5 to 8 m for machine built and tractor-cultivated ones. • Terraces should drain runoff along the horizontal gradient of the slope, either in outward or reverse direction. The outward gradient can range from 0.5% in arid or semi-arid regions to 3% in humid regions with clay soils. Maximum gradients can be 5% for reverse terraces. In high rainfall areas (more than 1000 mm annually), it is necessary to make additional drainage provisions off the terraces – although this has a risk of causing erosion on very steep slopes. • These additional drainage channels should be trapezoidal in shape and planted with grass to prevent erosion. Machine construction is possible on slopes of 12-36% while manual construction can be used on slopes of 12-47%.
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI.

	Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau.
Partner organizations	County Government extension offices.

2.6.4. Fanya Juu Terraces


TIMP Name	Fanya Juu Terraces  <p style="text-align: center;">Fanya Juu</p>
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	The risk of soil erosion and increased run off; low soil water retention capacity in most soils
What is it? (TIMP description)	<p>‘Fanya juu’ terraces (juu is Swahili word for ‘up’) are constructed by excavating soil and throwing it up-slope to make an embankment. The embankment forms a runoff barrier and the trench (ditch) is used to retain or collect runoff.</p> <p>The embankments are usually stabilized with fodder grasses. Crops, such as sweetpotato may then be grown in the ditches. Through gradual redistribution of soils within the field, the terraces level off.</p> <p>The technology is highly suitable in low annual rainfall areas (less than 700 mm); moderate slopes (less than 20%); deep soils (more than 60 cm); and hilly areas that are subject to widespread erosion.</p>
Justification	<p>The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs.</p> <p>Agricultural production is threatened in many parts of the Kenya by soil erosion and limited soil moisture.</p> <p>Conservation of soil and moisture through construction of terraces has led to better and more reliable crop yields especially in the ASAL counties of Kenya.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers

Approaches to be used in dissemination	<ul style="list-style-type: none"> • Approaches to be used in the dissemination include: • On-farm demonstrations during farmer field schools • Training in workshops. • Extension information materials which will be distributed to farmers through farmer groups and the County extension service providers. • FFBS • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct contour bunds. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Migori
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Increased risk of soil erosion if terraces are improperly laid out • Labour intensive and many farmers may find it difficult to implement at large scale • Land tenure systems – communal land ownership, or in places where individuals don't have land title deeds
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate equipment for preparation of terraces for efficiency and increased output per man hour. • Training youthful farmers to be champions of 'fanya juu' terraces construction at the Ward level/village level. • Training on site specific designs and construction of 'fanya juu' terraces • Fast-track land registration
Lessons learnt, if any	<ul style="list-style-type: none"> • 'Fanya juu' terracing is popular due largely to the rapid benefits it gives in terms of soil and water conservation. • Existence of well-developed self-help groups can lead to successful soil and water conservation activities. • Conducting well publicized campaigns has been found to add to the success of soil and water conservation. • Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low-cost technologies for soil and water conservation • Policies that support individual land tenure systems
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The main input cost is the labour for <i>terrace</i> preparation. The cost will depend on the land size and the landscape terrain/slope
Estimated returns	<ul style="list-style-type: none"> • The returns depends on the value chain being addressed
Gender issues and concerns in development, dissemination, adoption and	<ul style="list-style-type: none"> • The technology is labour intensive therefore may increase women labour burden • Women have less access to agricultural information, technology and

scaling up	<p>knowledge</p> <ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land, quality seed and credit • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	Potential to create employment for youth through provision of the labour required
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • The technology is labour intense and may be difficult for the VMG to implement in the field. • The labour cost of adopting this technology might be out of reach for the VMGs thus affecting adoption and scaling up • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities exist for unemployed youth exists in provision of labour
E: Case studies/profiles of success stories	
Success stories, if any	Over 50,000 smallholder farmers in lower Eastern counties of Kenya are recording a more than doubling of yields and reduced soil erosion after embracing a soil conservation scheme that involves digging of trenches in hillside to trap runaway water and soil.
Application guidelines for users	<ul style="list-style-type: none"> • The ‘fanya juu’ trench is 60 cm wide by 60 cm deep, and the bund 50 cm high by 150 cm across 19. In arid regions the trenches can be enlarged to 150 cm deep and 100 cm wide. • Distance between bunds can be from 5 m on steep slopes to 20 m on gentle slopes. Stone terrace walls can be built to reinforce the bunds on very steep slopes to allow surplus water to pass between the stones without damaging the terrace. • Excess water can be drained from the trenches using cut-off drains.
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau.
Partner organizations	County Government extension service.

2.6.5. Stone lines


TIMP Name	Stone lines
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	 <p style="text-align: center;">Stone lines</p>
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	The risk of soil erosion and increased run off; low soil water retention capacity in most soils
What is it? (TIMP description)	<ul style="list-style-type: none"> • Stone lines are stones placed along contour lines to slow down runoff. With time, the soil builds up on the upslope side of the stone line and a natural terrace is formed. • The technology is suitable in gentle to moderate slopes (less than 10%); areas with low annual rainfall areas (200 - 750 mm); and stony areas
Justification	<ul style="list-style-type: none"> • The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs. • Agricultural production is threatened in many parts of the Kenya by soil erosion and limited soil moisture. Stone lines can help in the conservation of soil and moisture.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Approaches to be used in the dissemination include: • On-farm demonstrations during farmer field schools • Training in workshops. • Extension information materials which will be distributed to farmers through farmer groups and the County extension service providers • FFBS • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct stone lines. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools; provide collective labor. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Migori

Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Increased risk of soil erosion if stone lines are improperly laid out • Labour intensive and many farmers may find it difficult to implement at large scale • Land tenure systems – communal land ownership, or in places where individuals don't have land title deeds
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate tools for preparation and laying of stones lines for efficiency and increased output per man hour. • Training youthful farmers to be champions of laying stone lines and maintenance. • Training on site specific designs and laying of stone lines • Fast-track land registration
Lessons learnt, if any	<ul style="list-style-type: none"> • Existence of well-developed self-help groups can lead to successful construction of stone lines. • Conducting well publicized campaigns has been found to add to the success of soil and water conservation. Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low cost technologies for soil and water conservation • Policies that support individual land tenure systems
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	For each hectare, transport and other project costs amount to around KES 25,000.
Estimated returns	The returns depends on the value chain being addressed
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The technology is labour intensive therefore may increase women labour burden • Women have less access to agricultural information, technology and knowledge • Women and youth have limited access to productive resources such as land, quality seed and credit • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Potential to create employment for youth through provision of the labour required
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities exist for youth exists in provision of labour
E: Case studies/profiles of success stories	
Success stories, if any	<ul style="list-style-type: none"> • In Burkina Faso farmers have reported doubled cereal production when stone lines are used in combination with greater use of compost as fertilizer. <p>https://www.rural21.com/fileadmin/migrated/content/uploads/Stone_li</p>

	nes_against_desertification_01.pdf
Application guidelines for users	<ul style="list-style-type: none"> • Stone lines are built along the contours. The lines are between 0.5 and 1.5 m high, depending on the gradient of the slope. The distance between stone lines ranges from 25 to 40 m. • Each hectare needs between 30 and 50 tons of stones, which are built into contour lines about 300 m long. The stone lines slow the fast-flowing rainwater, thereby reducing erosion. This allows up to 200 more litres of water to penetrate the soil per square metre. • The amount of work involved is considerable: to quarry the stone, load it onto lorries and line it on the fields.
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau and A.O. Esilaba, F.M.Wandera
Partner organizations	County Government extension service.

2.6.6. Retention ditches


TIMP Name	Retention ditches  Retention Ditch
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	The risk of soil erosion and increased run off
What is it? (TIMP description)	<ul style="list-style-type: none"> • Retention ditches are trenches designed to catch and retain incoming runoff and hold it until it infiltrates into the ground. They can be an alternative to waterways in high rainfall areas, but they are most often used in semi-arid areas to harvest water. • The technology is suitable in semi-arid areas; permeable, deep and stable soils; and on flat or gentle sloping land.
Justification	<ul style="list-style-type: none"> • The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs. Agricultural production is threatened in many parts of the • Kenya by soil erosion and limited soil moisture. Conservation of soil and moisture through construction of retention ditches has led to better

	and more reliable crop yields.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Approaches to be used in the dissemination include: • On-farm demonstrations during farmer field schools • Training in workshops • Extension information materials which will be distributed to farmers through farmer groups and the County extension service providers • FFBS • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour as the technology is labour intensive. • Farmers and extension service with skills to design and construct stone lines. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools; provide collective labor. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Migori
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Increased risk of soil erosion if retention ditches are improperly laid out • Labour intensive and many farmers may find it difficult to implement at large scale • Land tenure systems – communal land ownership, or in places where individuals don't have land title deeds
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate tools for digging out retention ditches for efficiency and increased output per man hour. • Training youthful farmers to be champions of digging out retention ditches. • Training on site specific designs and layout • Fast-track land registration
Lessons learnt, if any	<ul style="list-style-type: none"> • When the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low cost technologies for soil and water conservation • Policies that support individual land tenure systems
• D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The main input cost is the labour for digging retention ditches. • The cost will depend on the land size and the landscape terrain/slope
Estimated returns	<ul style="list-style-type: none"> • The returns depends on the value chain being addressed
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • It is labour intensive in terms of preparation and application hence may not be adopted by women who are already overburdened • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the

	<p>required inputs such as seeds than men.</p> <ul style="list-style-type: none"> • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunity exist for youth during implementation • The technology is acceptable and easy to upscale by both males and female gender
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as seeds than men • Women have less access to agricultural information, technology and knowledge than men • The technology is labour intensive and may be difficult for the VMG to implement in the field
VMG related opportunities	<ul style="list-style-type: none"> • Affirmative action in various areas as for instance in the provision of finances to VMGs • Increased production will lead to increased consumption and utilization of sweetpotatos and hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories, if any	Over 50,000 smallholder farmers in Eastern and Central Kenya are recording a more than doubling of yields and reduced soil erosion after embracing a soil conservation scheme that involves digging of retention trenches in hillside to trap runaway water and soil.
Application guidelines for users	<ul style="list-style-type: none"> • The ditches are dug to about 30-60 cm depth and 0.5-1 m width across the direction of the slope. In very stable soils it is possible to make the sides nearly vertical, but in most cases the top width of the ditch needs to be wider than the bottom width. • The soil is thrown to the lower side of the slope to prevent it falling back in and form an embankment. On flat land, ditches are spaced at about 20m and have closed ends so that all rainwater is trapped. • On sloping land ditches are spaced at 10 - 15 m intervals and may have open ends to discharge excess water.
F: Status of TIMP readiness	
Ready for upscaling, Requires validation; Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau and A.O. Esilaba F.M.Wandera
Partner organizations	County Government extension service.

2.6.7. Grass strips


TIMP Name	Grass strips
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	 <p style="text-align: center;">Grass strip</p>
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	The risk of soil erosion and increased run off
What is it? (TIMP description)	<ul style="list-style-type: none"> • Grass strips are dense strips of grass planted up to a meter wide, along a contour. With time, silt builds up above the strip and benches are formed. • Grass strips can be planted along ditches to stabilize them, or on the rises of bench terraces to prevent erosion. They are a popular and easy way to terrace land, especially in areas with relatively good rainfall. • The technology is suitable in regions with fairly gentle slopes (0 - 6%); grass is needed for fodder; and high rainfall areas.
Justification	<ul style="list-style-type: none"> • Agricultural production is threatened in many parts of the Kenya by soil moisture stress and serious soil erosion. Conservation of soil and moisture through construction of grass strips has led to better and more reliable crop yields.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Approaches to be used in the dissemination include: • On-farm demonstrations during farmer field schools • Training in workshops. • Extension information materials which will be distributed to farmers through farmer groups and the County extension service providers • FFBS • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour • Availability of land, apart from cropland. • Farmers and extension service with skills to design and construct stone lines. • Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government extension service providers – delivery of information to farmers, technology access, capacity building • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools; provide collective labor. • External service providers – capacity building and access to technology
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru

Counties where TIMP will be promoted	Migori
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Labour intensive for maintaining and controlling grass from becoming a weed • Reduced land area for crop production
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Farmers need to be supported with appropriate tools and suitable grass varieties. • Capacity building on the maintenance of grass strips. • Training on site specific designs and layout
Lessons learnt, if any	<ul style="list-style-type: none"> • Establishment of grass strips induces a process of natural terracing on slopes as soil collects behind the grass barrier, even in the first year. • Grass strips can be very appropriate for farmers who cut and carry fodder for their animals. • Grasses are also used as mulch for crops by farmers.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Enforce policies on soil and water conservation at the County level • Create awareness on the importance of soil and water conservation • Avail low-cost technologies for soil and water conservation
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The main input cost is the labour for establishing grass strips. The cost will depend on the type of grass to be planted, land size and the landscape terrain/slope
Estimated returns	The returns depend on the value chain being addressed and also type of grass
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The technology is labour intensive therefore may increase women labour burden • Women have less access to agricultural information, technology and knowledge • Women and youth have limited access to productive resources such as land, quality seed and credit • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Potential to create employment for youth through provision of the labour required
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • The technology is labour intense and may be difficult for the VMG to implement in the field. • The labour cost of adopting this technology might be out of reach for the VMGs thus affecting adoption and scaling up • The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities exist for youth exists in provision of labour
E: Case studies/profiles of success stories	
Success stories, if any	-

Application guidelines for users	<ul style="list-style-type: none"> • Spacing between grass strips depends on the slope of the land. It can be 20-30 m on gentle slopes and 10-15m on steep land. • Grass strips can be planted along ditches to stabilize them, or on the rises of bench terraces to prevent erosion. The grass needs to be trimmed regularly, to prevent shading and spreading to cropped areas. • Various grass species are used, e.g., Vetiver, Napier, Guinea and Guatemala depending on what is locally available. Vetiver grass is drought resistant and good for reducing erosion.
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau and A.O. Esilaba F.M.Wandera
Partner organizations	County Government extension service.

2.6.8. Tied ridges /Ridging /Earthing

TIMP Name	Tied ridges /Ridging /Earthing  Tied ridges
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Crop water stresses in production; Increased water losses in the furrows
What is it? (TIMP description)	Tied ridges are small earthen ridges, 30 cm high, with an upslope furrow which accommodates water between the ridges. Technology consist of water flowing down the small trenches/furrows running parallel and infiltrates into crop root zones. Water is applied to the top end of each furrow and flows down the crop field under the influence of gravity.
Justification	With limitations in soil moisture due to decreasing rainfall occasioned by climatic changes, tied ridges helps conserve soil moisture. In combination with furrow irrigation, the technology has potential to improve agricultural productivity and increase crop yields and cropping intensities. As a result, household food security, incomes and livelihoods are enhanced.
Region promoted	Tana River, Garissa, West Pokot counties
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • Agricultural Trade Fairs • Mass media • Chief's Baraza • Farmer Field and Business Schools (FFBS), • On-farm and on-station demonstrations, • Field Days • Extension Officers • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Proximity to water sources - close to permanent water sources • Suitable topography of area (level land) • Technical capacity for maintenance
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government – capacity building • Private sector – access to credit, capacity building • NGOs (Kenya Red Cross (KRC), Action Aid, World Vision, and OXFAM) – capacity building, credit facilities, facilitate technology access • National Irrigation Board – technology access and capacity building • Water Resources Management Authority – Water resources use management
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
Counties where TIMP will be promoted	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Can be labour intensive during establishment phase • Poor management may lead to water use inefficiencies • Limited access to credit may limit uptake • Land tenure insecurity in some counties limits adoption and investments
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Enhancing farmers' capacity to see benefits • Enhance access to credit • Implement policy on land use and tenure
Lessons learnt	<ul style="list-style-type: none"> • Use of tied ridges with furrow irrigation significantly increases yields • Poor management and designs may often result in flooding of low areas • Assessment of soil erosion and sediment is key to sustainability
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • The economics of furrow irrigation needs to be well articulated • Enhanced land quality control to mitigate against soil salinity • Adequate policies and guidelines regarding water abstraction from the main water sources to minimize resource conflicts especially along river downstream. • Market for the crops produced under irrigation should be identified early enough to minimize losses and increase profitability from the system
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not known
Estimated returns	Not known
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • It is labour intensive in terms of preparation and application hence may not be adopted by women who are already overburdened • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the

	<p>required inputs such as seeds than men.</p> <ul style="list-style-type: none"> • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have less access to agricultural information, technology and knowledge than men
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Employment opportunity exist for youth during implementation • The technology is acceptable and easy to upscale by both males and female gender
Gender related opportunities	<ul style="list-style-type: none"> • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may also have limited access to finances to buy the required inputs such as seeds than men • Women have less access to agricultural information, technology and knowledge than men • The technology is labour intensive and may be difficult for the VMG to implement in the field
VMG related opportunities	<ul style="list-style-type: none"> • Affirmative action in various areas as for instance in the provision of finances to VMGs • Increased production will lead to increased consumption and utilization of sweetpotatos and hence improved health of VMGs

E: Case studies/profiles of success stories

Success stories	<ul style="list-style-type: none"> • There are successful models for such technology i.e. Mwea and Perkerra irrigation schemes where furrow irrigation systems have provided opportunities for local community to produce high value crops. • A sound understanding of the roles and responsibilities of farmers and water user associations is a feature of successful system.
Application guidelines for users	<ul style="list-style-type: none"> • Sijali I V. Drip irrigation: options for smallholder farmers in Eastern and southern Africa. 2001. • RELMA Technical Handbook Series 24. Nairobi, Kenya: Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency, (Sida). 60 p. + x p.; includes bibliography • FAO CSA Manual • FAO Irrigation Water Management: Irrigation Manual • GoK MoALFC: Training Manual for Water Users Association and farmers

F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research) | Ready for upscaling

G: Contacts


Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO; J. Mwaura, I. Sijali
Partner organizations	<ul style="list-style-type: none"> • National Irrigation Board (NIB), • Water Resources Management Authority

Research gap

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

2.6.9. Rain water harvesting systems (ponds and dams)

TIMP Name	Rain water harvesting systems (ponds and dams)
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	 <p style="text-align: center;">Water harvesting pond</p>
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed:	Water scarcity for crop and livestock use especially in the face of diminishing rainfall because of climate change
What is it? (TIMP description)	<p>Rain water harvesting is a technique of collection and storage of rainwater into natural reservoirs or tanks, or the infiltration of surface water into subsurface aquifers (before it is lost as surface runoff).</p> <p>A vast number of techniques allow flexibility and adaptability to site-specific situations to best fight water scarcity and make agricultural production more resilient. One method of rainwater harvesting is rooftop harvesting and harvesting through earth dams.</p>
Justification	<p>Water, especially in the ASALs, is the most limiting factor to land productivity. It is also a major driver of soil erosion and land degradation. Therefore, there is need to enhance water harvesting and storage</p> <p>By collecting, storing and utilizing water agricultural purposes, farmers are able to prevent soil erosion, stabilize water supply, and reduce reliance on other water sources.</p> <p>Smallholder farmers can also recoup initial investment costs in water harvesting by planting high-value crops, and extending their growing season through the entire year. Technology also slows water runoff and increases yields with the additional water.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, pastoralists and agro-pastoralist
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Demonstrations on technology use; • Farmer Field and Business Schools; • Technical training and re-tooling of extension personnel; • Awareness creation through various platforms like local FM stations • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Avail resources (human, technical and financial) to support acquisition and establishment of water harvesting systems • Policy to support use of communal land to establish and manage the earth dams • Policies supporting Public-Private Partnerships in water harvesting • Sensitization of local communities to embrace the practice
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Private sector – access to technology, access to credit, technology installation

	<ul style="list-style-type: none"> • County government – capacity building, policy support, credit facilities, • NGOs – access to technologies, capacity building, technology installation
C: Current situation and future scaling up	
Counties where already promoted	Most counties are investing on water harvesting technology at community level. More is required to increase uptake by farmers in ASALs.
Counties where TIMP will be up scaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • High and other counties with suitable agro-ecological conditions for sweetpotato production costs related to technology access and management • Resource use conflicts where land is communally owned • Limited skills in technology installation and management • Limited community mobilization policy for water related activities • Lack of suitable training programs in rainwater harvesting • Lack of proper water usage and control measures • In the case of earth dams where there is a lot of siltation, regular de-siltation is required. • Threats to sustainability of established systems because of lack of community participation in systems monitoring and maintenance. • Vandalism • Some systems require high investment costs.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Resource mobilization through partnerships with private sector • Engaging a participatory process during the planning and implementation of the project. • User specific training programs water harvesting technologies, maintenance and operation skills • Cost of buying water harvesting structures is very high for most households and needs to be reviewed. • Securing systems to prevent vandalism
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Potential to caution community against water scarcity • Improved productivity where water harvesting has been implemented.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Devise systems that are gender sensitive – target different gender needs • Carry out environment and social impact assessment of the technology in specific Counties and cultures • Support structures that help access to credit for technology access and maintenance • Enact Policy frameworks to support water harvesting • Enact policies on land tenure systems to support water harvesting
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Not determined • Not affordable to most rural households.
Estimated returns	<ul style="list-style-type: none"> • Time saved fetching water from afar is channeled into other economic enhancing activities. • Money used to treat diseases related to poor water hygiene is used for other activities. • Healthy population will have energy to provide labour required in agricultural activities
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • The technology will reduce women’s time burden of walking far distances in search for water • The technology requires heavy capital investment that may be out of

	<ul style="list-style-type: none"> reach for women Women have less access to land for dam construction Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> Potential for youth employment during implementation of the technology Water harvesting facilities save the time spent for fetching water especially by women. The saved time will be channeled into other economic activities
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> The labour cost of adopting this technology might be out of reach for the VMGs thus affecting adoption and scaling up VMGs have limited access to land for dam construction VMGs have less access to agricultural information, technology and knowledge than men
VMG related opportunities	The technology will reduce the time burden of fetching water by the VMGs

E: Case studies/profiles of success stories

Success stories	<ul style="list-style-type: none"> Agro-pastoralists who adopted water harvesting technology have had sustained source of income and improved livelihoods A typical African Water Bank rainwater harvesting system collects 400,000 to 450,000 litres of rainwater within two to three hours of steady rain. It has an artificial roof of 900 to 1,600 square metres and storage tanks. The largest tank constructed in Narok County has a capacity of 600,000 litres. This amount of water can serve a community of 400 people for approximately 24 months without extra rain. The capacity can be added at a rate of 220,000 litres per year. The system is low cost and can be 100 percent maintained locally. It also uses local skills, labour, materials and technology. Apart from boosting access to water in arid and semi regions, rainwater harvesting contributes to water conservation thus reducing overexploitation of water resources.
Application guidelines for users	<ul style="list-style-type: none"> Handbook on Rainwater Harvesting and Storage Options Manual for Rooftop Rainwater Harvesting Systems in the Republic of Yemen

F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	Ready for upscaling
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G: Contacts


Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO, Isaya Sijali, J. Mwaura, P. Ketiemi
Partner organizations	County government, Public Private Partnerships (PPP)

Research gap

- Development of models of rain water harvesting for intensive agricultural production and household use.

2.6.10. Conservation Agriculture

TIMP Name	Conservation Agriculture
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	 <p style="text-align: center;">Conservation agriculture practice of maximum ground cover</p>
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed:	Land degradation characterized by the declining soil fertility, low yields, increased soil moisture stress, increased soil erosion and loss of biodiversity
What is it? (TIMP description)	<p>Conservation agriculture is management practice which maximizes on saving water on the farming by adhering to specific principles that govern it.</p> <p>The practices that make up this approach follow key principles that target to conserve the soil, soil moisture, and soil-nutrients, and stabilize land production while reducing production costs.</p> <p>Conservation agriculture principles are: 1. Minimal soil disturbance, 2. Permanent ground cover - maintenance of a mulch of carbon-rich organic matter covering and feeding the soil (e.g. straw and/or other crop residues including cover crops), 3. Crop rotation or sequences and associations of crops including trees, which could include nitrogen-fixing legumes</p>
Justification	<p>Land productivity is decreasing leading to decreased yield. Continuous land operation continues to emit more GHGs (Carbon) responsible for the climatic changes. Conservation agriculture has potential to:</p> <p>Enhance management of soil fertility and organic matter, and improvement of the efficiency of nutrient inputs, helping to produce more with proportionally less fertilizer.</p> <p>Rotations and crop associations that include legumes are capable of hosting nitrogen-fixing bacteria in their roots; this contributes to optimum plant growth without increased GHG emissions induced by fertilizer production</p> <p>Avoidance of tillage minimizes occurrence of net losses of carbon dioxide by microbial respiration and oxidation of the soil organic matter and builds soil structure and bio pores through soil biota and roots</p> <p>The protective soil cover of leaves, stems and stalks from the previous crop shields the soil surface from heat, wind and rain, keeps the soil cooler and reduces moisture losses by evaporation</p> <p>Helps to reduce soil compaction and plough pans and regenerates degraded lands</p>
B: Assessment of dissemination and scaling up/out approaches	


Users of TIMP	Farmers, Extension Agents, Researchers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Agricultural Trade Fairs • Mass media • Chief's Baraza • Farmer Field and Business Schools (FFBS), • On-farm and on-station demonstrations, • Field Days • Extension Officers • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Training on principles and benefits of conservation agriculture • Model demonstration using crops
Partners/stakeholders for scaling up, their roles and stage of involvement	<ul style="list-style-type: none"> • County Extension officers - Dissemination of information, capacity building • NGOs (African Conservation Network, One Acre Fund)- Capacity Building, Dissemination of information • CIAT, FAO – capacity building • County Governments - Funding conservation agriculture activities, support capacity building, enabling environment and supportive policies
C: Current situation and future scaling up	
Counties where already promoted if any	Bungoma, Meru, Embu, Tharaka Nithi, Laikipia, Kakamega
Counties where TIMP will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Non-availability of crop residue in suitable quantities • Competition for crop residues with other uses like wood fuel and livestock • Land tenure (farmers reluctant to invest in conservation agriculture where they do not have clear land rights) • Limited knowledge on the incremental benefits of conservation agriculture • Limited access to conservation agriculture implements
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Enhance Public Private Partnerships (PPP) to support increased production and market access • Improve KALRO and County government capacity to train and re-tool technical team so as to enhance uptake of the technology • Allocation of more funds for continued research and dissemination of this technology would aid increased uptake of conservation agriculture with agroforestry
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Uptake of conservation agriculture increases with the realized incremental benefits over time • Continuous capacity building increases conservation agriculture uptake
Social, environmental, policy and market conditions necessary for development and dissemination	<ul style="list-style-type: none"> • Develop Integrated Herbicide Management Plan – pre-emergence and post-emergence herbicides • Reliable technology adoption and suitable price and market access for produce under conservation agriculture • Continuous capacity building of the community on the benefits of conservation agriculture • County policies that support households investing in conservation agriculture with inputs like implements
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	Costs related to ripping services and herbicides amount to KES 5000/acre. This is apart from the normal inputs of seed and fertilizer when establishing. But the costs of reduce over the years, while the returns increase
Estimated returns	<ul style="list-style-type: none"> • Reduction of costs associated with tillage-induced soil erosion and degradation i.e. 40% of land degradation • Returns on conserving soil exceeding 150 ton/hectare annually and associated increased productivity
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Reduction of costs associated with tillage-induced soil erosion and degradation (40% of land degradation) • Returns on conserving soil exceeding 150 ton/hectare annually and associated increased productivity
Gender related opportunities	<ul style="list-style-type: none"> • Conservation agriculture with trees is a management practice that is friendly for all the gender categories • Women have less access to land than men • Women and youth have limited access to the equipment used for conservation agriculture than men • Women have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • conservation agriculture reduces women workload so that they can venture in other economic activities
VMG related opportunities	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit and quality seed • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers and agro-pastoralists who adopt the technology have had sustainable source of income and increased resilience
Application guidelines for users	References <ul style="list-style-type: none"> • Okoba, B. (2018), Climate-Smart Agriculture: Training Manual for Agricultural Extension Agents in Kenya. • Esilaba, E.O (2019), KCEP-CRAL CSA Extension Manual • SUSTAINET EA 2010. Technical Manual for farmers and Field Extension Service Providers: Conservation Agriculture. Sustainable Agriculture Information Initiative, Nairobi
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO, E. Mutuma
Partner organizations	County government, Private Public Partnerships

Research gaps

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

2.6.11. Sweetpotato – Legume/cereal intercropping

<p>TIMP Name</p>	<p>Sweetpotato – Legume/cereal intercropping</p>  <p style="text-align: center;">Sweetpotato- cereal intercrop</p>
<p>Category (i.e. technology, innovation or management practice)</p>	<p>Complementary technology</p>
<p>A: Description of the technology, innovation or management practice</p>	
<p>Problem addressed:</p>	<ul style="list-style-type: none"> • Decreased yields, hence low farm returns • Declining soil fertility, hence soil degradation • Soil erosion problems - runoff are minimized • Weed infestation – manage using increased soil cover crops • Vulnerability to crop pests - practice helps slow the proliferation of pests and protect yields
<p>What is it? (TIMP description)</p>	<p>Intercropping is a multiple cropping practice involving growing two or more <u>crops</u> in together. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources or ecological processes that would otherwise not be utilized by a single <u>crop</u>.</p> <p>The practice offers the potential to increase yields, enhance soil fertility and minimize the effects of climate change.</p> <p>Single row intercropping: involves the component sweetpotato and the pigeon pea arranged in alternate single rows.</p> <p>Spacing. The space between the two sweetpotato rows is 150cm and the legume is planted in between so that between legume and sweetpotato row is 100cm.</p> <p>Strip intercropping: multiple rows, or a strip, of the legume is alternated with single or several rows of sorghum.</p> <p>Spacing. The inter row spacing between legume is 100cm and legume to sweetpotato is 100 cm. The space between two sweetpotato rows is 100cm.</p> <p>Control of pest through intercropping</p> <p>Push-pull cropping, this is a mixture of trap cropping and repellent intercropping. An attractant crop attracts the pest and a repellent crop is also used to repel the pest away.</p> <p>Trap cropping, this involves planting a crop nearby that is more attractive</p>

	<p>for pests compared to the production crop, the pests will target this crop and not the production crop.</p> <p>Repellent intercrops, an intercrop that has a repellent effect to certain pests can be used. This system involved the repellent crop masking the smell of the production crop in order to keep pests away from it.</p>
Justification	<p>Climate change is negatively impacting agricultural productions. Farmers are experiencing low yields, crop failures, declined soil fertility and generally low farm returns from their investments.</p> <p>Intercropping is one of the potential management practices of enhancing climate change adaptation. It offers the potential to increase yield, enhance soil fertility/biodiversity and minimize the effects of climate change.</p> <p>The practice is known to build healthy soils, control pests and harness a variety of benefits to increase yields. Intercropping of compatible plants encourages <u>biodiversity</u> by providing a habitat for a variety of <u>insects</u> and <u>soil organisms</u> that would not be present in a single-crop environment.</p> <p>The practice has several advantages. First, an intercrop may use resources of light, water, and nutrients more efficiently than single crops planted in separate areas, and this can improve yields and income. Secondly, crop mixtures frequently have lower pest densities, especially of insect pests. This occurs both because the mixture confuses the insects and, if chosen carefully attracts beneficial predators. Finally, intercropping may allow more effective management of cover crops.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers and wide range of users
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Agricultural Trade Fairs • Mass media • Chief's Baraza • Farmer Field and Business Schools (FFBS), • On-farm and on-station demonstrations, • Field Days • Extension Officers • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Awareness creation on the benefits and contribution of the practice to all stakeholders. • Easy access of legume varieties that are compatible with potatoes • Technical packages describing appropriate schedules of planting intercrop. • Package on fertilizer rates and regimes under the practice.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County governments – to provide extension services, farmer mobilization and policy formulation • NGOs – to provide support on capacity building and micro-financing services
C: Current situation and future scaling up	
Counties where already promoted	Most counties in the medium to high rainfall areas & arid and semi-arid areas
Counties where TIMP will be up scaled	West Pokot and any other county with suitable agro-ecological conditions

	for sweetpotato production
Challenges in dissemination	<ul style="list-style-type: none"> • Limited access and wide distribution of clean planting materials (intercrop varieties) • Inadequate access of technical materials on the establishment, operations and management of intercrop management practice by farmers • The increased effects of climate change hindering adoption. • Farmer high poverty levels coupled with illiteracy especially in deep rural areas of Kenya.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Enhance access of clean planting materials across the counties. • Work closely with certified seed merchants, research institutions • Train and sensitize farmers on the basic principles of intercropping, their benefits and types suitable to their contexts. • Use farmer field schools and demonstrations • Develop a comprehensive manual on the practice to guide the farmers during the adoption
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • The practice is very important in pest management. Farmers can use a trap crop to attract pests, keeping them away from the main crop. Therefore, farmers can easily adopt this method to significantly cut down on pesticides input costs • The number of ecological benefits provided by this practice can also accelerate upscaling. Intercropping promotes interactions between crops and pollinators, thus supporting biodiversity and wildlife species.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Socially accepted by both male and female gender. • The practice is environmentally friendly as it enhances biodiversity, controls erosion and minimizes use of pesticides
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	This is a low cost management practice though technically demanding especially where the objective is to control pest through intercropping
Estimated returns	Dependent on the value chain intercrop
Gender issues and concerns in development, dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women and youth have limited access to the equipment used to make the water pan than men • Women have less access to land that can be used for water pan than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	Intercropping offers good opportunities to both men and women to grow diverse crops for economic gains and at the same time offers enhanced biodiversity benefits
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • 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	Intercropping places emphasis on the importance of using available land space to grow diverse of food crops, increase biodiversity, pest

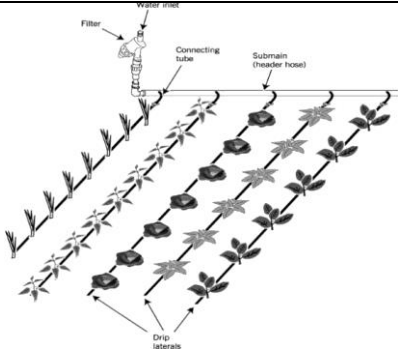
	management thus the practice is economically viable for the VMGs
E: Case studies/profiles of success stories	
Success stories	Farmers have reported improved soil conditions, reduced runoff and nutrient loss, soil moisture retention in the soil and generally an increased crop production following application of this widely used and readily available management practice.
Application guidelines for users	<ul style="list-style-type: none"> • Intercropping scheme is aimed at improving the overall economics of the farm. It is for this reason any new intercropping idea should first be tested on a relatively small area for evaluations • Observe careful timing of field operations (sometimes necessitating special interventions) to keep competition between the intercropped species in balance • A crop mix that works well in one year may fail the next if weather favors one crop over another. • A mixture of crops with different growth forms or timing of development may make cultivation and use of mulches more difficult and less effective • Planting crops in alternate rows or strips greatly simplifies management and captures some of the benefits of intercropping for pest control • Intercropping poses a special problem for crop rotation. This is because if plants from two families are mixed in the same bed or field, achieving a substantial time lag before replanting either of those families may be difficult • Intercropping requires extra care and effort in planning and maintaining a viable crop rotation.
F: Status of TIMP readiness (Ready for upscaling: Requires validation; Requires further research	Requires further research
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO, P. Ketieme, E. Mutuma, M. Okoti, D. Kamau, A.O. Esilaba
Partner organizations	County governments, KCEP-CRAL project

Research gaps

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

2.6.12. Drip irrigation systems for small-scale farmers

TIMP Name	Drip irrigation systems for small-scale farmers
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	 <p style="text-align: center;">Layout of a drip irrigation system in vegetables</p>
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Increased crop water stress caused by seasonal rainfall variability in rain fed production.
What is it? (TIMP description)	The technology that supplements water in crop production systems. It allows the optimal usage of the limited water resource by dripping water slowly into the crop roots at low pressure through a number of emission points (drippers). Drip system saves water by minimizing evaporation losses and delivering water at the root zone where it is required. It also provides the opportunity for farmers to increase crop yields. It's easy to design and operated. The layout can either be above surface or buried below the surface. System provides efficient fertilizer usage (fertigation) with irrigation water
Justification	The impacts of climate change (seasonal rainfall variability and drought) to crop production is a real threat to food security. Mainstreaming drip irrigation systems into crop production provides the opportunity for farmers to enhance crop resilience, increase yields and incomes.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Model Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • Agricultural Trade Fairs, • Mass media • Chief's Baraza • Farmer Field and Business Schools (FFBS) • On-farm and on-station demonstrations • Field Days • Extension Officers • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Correct field design (system installation) of the drip system to minimize water inefficiencies. Training of farmers and extension • Drip management skills
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County governments; capacity building, supportive policies and frameworks • Private sector (AMIRAN); facilitate access to technology; technology demonstration; access to credit • NGOs (Kenya Red Cross- KRC, Action Aid, World Vision, and OXFAM); facilitate access to technology; technology demonstration
C: Current situation and future scaling up	

Counties where already promoted if any	Makueni, Bomet, Kajiado, Machakos
Counties where TIMP will be promoted	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Relatively high cost of drip kits for majority of poor resource farmers in ASALs. • High temperatures experienced in ASALs cause water salinity challenges • Drip poly tubing also tend to collapse causing inadequate water conveyance along the tube • Limited knowledge on the drip irrigation technology and its management
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Model farmer demonstration would create awareness and willingness to invest on the system • Modification of drip system tubes in ASAL areas is required (use of PVC pipes) to manage clogging free flow of water • Regular maintenance of the system especially the drip filters is required to flush out accumulated salts that tend to clog emitters • Intensive farmer training is required on the management of drip irrigation system
Lessons learnt	<ul style="list-style-type: none"> • Drip system increases yield, incomes and food security • Linking farmers with markets is critical for enhancing sustainability • Covering the soil with organic matter (crop residue or green manures) in a drip system have also helped preserve moisture and additional nutrients to the soil • It is also important to link farmers to Micro Finance Institutions for financial needs
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Capacity building for increased awareness • Policy support for increased investments in Drip irrigation systems • The water quality should be known to adjust the drip systems to avoid clogging
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Inputs materials include water source, drip lines, drippers and pumping unit, filtering and fertilizing systems. ¼ acre costs between KES 50, 000 to KES 100,000
Estimated returns	<ul style="list-style-type: none"> • Income from drip system rises by as much as 35% stemming from the management of crop water stresses. • Increased water saving means more water are available for other competing needs (domestic, livestock or industrial).
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Drip systems are easily installed and therefore suitable for both male and female gender • Drip system tend to reduce workload for all gender and provides significant positive impact on family food and nutritional intake. • Women are extensively involved in most horticultural farming enterprises (i.e. vegetable farming) under the drip-irrigation systems. This may increase their labor hours • Acceptable and easy to scale up by both male and female, including youth
Gender related opportunities	Opportunities available for women and men to generate sustainable income

VMG issues and concerns in development, dissemination, adoption and scaling up	The technology fits well with the VMGs and easily installed and manageable, thus improving nutrition for the VMG
VMG related opportunities	Drip technology reduces the workload to the VMGs and provides an opportunity to make business because they are mostly done on high value crops such as sweetpotato and other vegetables
E: Case studies/profiles of success stories	
Success stories	There are many successful farmer drip irrigation models across the country implemented by government and other development partners. It is noted that linking markets to crops under drip is crucial for sustainability.
Application guidelines for users	References <ul style="list-style-type: none"> • Isaya V. Sijali, 2001. Drip Irrigation: Options for smallholder farmers in eastern and southern Africa. Technical Handbook No. 24. Published by SIDA's Regional Land Management Unit, Nairobi. • FAO, 2014. Irrigation Techniques for Small-scale Farmers: Key Practices for DRR Implementers. Rome: Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/3/a-i3765e.pdf
F: Status of TIMP readiness (1. Ready for Up scaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO; Isaya Sijali
Partner organizations	AMIRAN Kenya, HortiPro, Agro-Irrigation, Aqua-Valley Services Ltd, Davis & Shirtliff, Micro finance institutions (MFIs)

Research gaps

- The impact of drip irrigation on economics of agriculture in the regions of adoption under study
- Limited irrigation packages suited to small farmers - improved irrigation, agronomy, credit, technical support and assistance with marketing – to spur adoption

2.7 SWEETPOTATO CROP HEALTH

2.7.1. Scouting for timely identification and control of sweetpotato diseases

TIMP name	Scouting for timely identification and control of sweetpotato diseases.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Limited awareness by farmers on the need to undertake scouting for disease attack in their fields.
What is it? (TIMP description)	This TIMP focuses on regular application of field inspection and monitoring techniques to determine the presence of the different types of diseases and their respective severities in order to make a decision on how and when to control them.
Justification	Most farmers spray pesticides indiscriminately in sweetpotato crop. This is not only uneconomical but also destructive to the environment and at the same time kills the beneficial insects while allowing various

	<p>phytopathogens to develop resistance against such pesticides. Scouting involves regular monitoring the incidences of disease damage to crops.</p> <p>The purpose is to gain a good understanding of, diseases, weed and beneficial insect activity in your crop. Effective monitoring includes assessing the number of plants infected as well as the beneficial insects in a crop together with the incidences of diseases and weeds. Recording this information and any control actions taken, will help to better understand your crop management practices over time.</p> <p>Scouting has to be done on a regular basis so that appropriate remedial measures are undertaken timely hence reducing crop losses as well as saving on the costs of chemicals.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension service providers, Agro-dealers.
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days. • FFBS • Agriculture innovation platforms • Farmer training • Agricultural shows and exhibitions as well as farmer to farmer training.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Collaboration between all partners. • Adequate facilitation: funds, logistics (transport) • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • MoALFC-Extension Service to conduct extension services and farmer trainings. • Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for sweetpotato production. • Universities to develop the technologies and conduct ToTs. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori.
Challenges in dissemination	Change of mind-set in favour of current practices maybe difficult to achieve.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness.
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	Approximately KES 400 per day for 4 months.
Estimated returns	KES 500,000 per acre.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to agricultural information, technology and knowledge than men • All gender categories can participate in field scouting
Gender related opportunities	<ul style="list-style-type: none"> • The technology is acceptable and easy to upscale by the various gender categories • Employment opportunities exist for youths in scouting
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge than men • The VMGs can easily participate in crop scouting once sensitized and this validates their inclusion into the production of sweetpotato.
VMG related opportunities	<ul style="list-style-type: none"> • Increased production due to limited disease attack will lead to increased consumption and utilization of sweetpotato and hence improved health of VMGs • Scouting for sweetpotatoes diseases can easily be undertaken by youths and other VMGs and hence lead to a reduction in costs for pesticides.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<ul style="list-style-type: none"> • Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on sweetpotato crop health management are documented. • Updated leaflets to be published
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for upscaling.
G: Contacts	
Contacts	The Center Director, Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO (FCRC Muguga South) - Harun Odhiambo,
Partner organizations	County and private Agricultural Extension service providers, CGIARs, agriculture-based NGOs and FBOs.

Research Gap

- Development of surveillance software systems for monitoring pests in sweetpotato fields.

2.7.2. Biological Control of Fusarium Wilt of sweetpotato with Cross-Protection by Prior Inoculation with Nonpathogenic *Fusarium oxysporum* n

TIMP name	Biological Control of Fusarium Wilt of sweetpotato with Cross-Protection by Prior Inoculation with Nonpathogenic <i>Fusarium oxysporum</i> n
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Excessive use of pesticides and yield loss due to the infection of sweetpotato by the disease
What is it? (TIMP description)	Cross-protection by prior inoculation with <i>F. oxysporum</i> isolates which are nonpathogenic not only to sweetpotato but also to several other species of major vegetable crop has a high potential for biological control

	<p>of Fusarium wilt in sweetpotato. Commercially, it is effective not only for the disease caused by soil borne inoculum but also for those transmitted from infested tubers and does not require the introduction of a complicated operation because sweetpotatoes are usually planted by cuttings. Nonpathogenic <i>F. oxysporum</i> isolates obtained from the vascular bundles of stems of healthy sweetpotato sprouts, and sometimes from those of tubers, using Komada's Fusarium selective medium have been tested for cross-protection ability against Fusarium wilt by dipping fresh cut ends of sweetpotato sprout in a diluted suspension of bud cells of each isolate produced in 7-day-old shake cultures. Fresh cut ends can be smeared with a condensed bud cell suspension paste. Soils can also be artificially infested by drenching with a bud cell suspension of the pathogen or by mixing with a small amount of a soil-wheat bran culture of the pathogen.</p>
Justification	<p>Fusarium wilt caused by <i>Fusarium oxysporum f. sp. batatas</i>, is a destructive soil borne disease commonly found in sweetpotato producing areas throughout the world and capable of causing up to 60% yield loss. The effectiveness of cultural practices is limited and the use of chemical fungicides raises public concerns about their possibly harmful effects on the environment and human health. Additionally, the control of Fusarium wilt depends heavily on chemical fungicide application. To date, no commercial sweetpotato cultivars are available with resistance to the highly aggressive strains of <i>Fusarium oxysporum</i>. Thus, there is the need to search for alternative and environmentally friendly strategies of controlling this disease.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension service providers, agro-dealers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days. • Farmer training • Agricultural shows and exhibitions as well as farmer to farmer training. • Agriculture Innovation platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Collaboration between all partners. • Adequate facilitation: funds, logistics (transport) • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • MoALFC-Extension Service to conduct extension services and farmer trainings. • Individual farmers farmer groups/CBOs to participate in the implementation of this management practice for successful production of sweetpotato. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already	-

promoted, if any	
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set by farmers in favour of current practices maybe difficult to achieve. • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Establish sweetpotato innovation platforms • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Farmer participatory approach is effective. • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Organized collective marketing channels critical for benefits to be derived from practice.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Approximately KES 50,000 per acre.
Estimated returns	Approximately KES 250,000 per acre.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land and quality seeds than men • Women have less access to finances to purchase the required chemicals than men • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in applying the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seeds • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to information on production techniques • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Reference</p> <ul style="list-style-type: none"> • Kei Ogawa and Hajimu Komada. Biological Control of Fusarium Wilt of sweetpotato with Cross-Protection by Prior Inoculation with Nonpathogenic <i>Fusarium oxysporum</i>. Environment Research Division, Central Agricultural Experiment Station (Konosu, Saitama, 365 Japan).

	https://www.jircas.go.jp/sites/default/files/publication/jarq/19-1-020-025_0.pdf	
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires further research.	
G: Contacts		
Contacts	The Institute Director, Food Crops Research Institute - Njoro P. O. Box 20107, Njoro, Kenya.	
Lead organization/scientists	KALRO (FCRI Njoro) – John Ndung’u KALRO (FCRC Muguga) – Harun Odhiambo,	
Partner organizations	<ul style="list-style-type: none"> • County and private Agricultural Extension service providers • CGIARs • Agriculture-based NGOs and FBOs. 	

Research gaps

- Evaluation of the biological control method for suitability in different agroecological zones in order to come up with region specific management practices.

2.7.3. Identification of disease-free areas for production of healthy sweetpotato seed

TIMP name	Identification of disease-free areas for production of healthy sweetpotato seed
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of clean seed materials and yield losses due to high disease incidences
What is it? (TIMP description)	This management practice involves the selection of suitable area or field for cultivation of sweetpotato for disease-free seeds and better yields. Healthy seed production is advisable in areas and seasons where disease does not appear. Many fungal and bacterial diseases are more severe in wet areas than in dry areas. It is also advisable not to use the same field for cultivation of sweetpotato year after year. Selection of same field may aggravate, for example, Cercospora leaf spot, Fusarium root rot and Alternaria leaf spot. The drainage in the field is also important since low-lying, waterlogged conditions favour most fungal diseases such as damping off and root rots in various agricultural crops.
Justification	<p>Phytopathogens present in the soil pose a serious threat in sweetpotato cultivation particularly at the seed production stage of this crop. Non-infested soil and safer areas are crucial for cultivation of different crops.</p> <p>Ploughing exposes the disease-causing organisms present in soil to scorching effects of solar radiations thus reducing their populations. The length of fallow period is also negatively correlated with the pathogenic population. The inoculum load of soil-borne pathogens can be lowered by integration of various cultural practices along with fumigation of soil and use of biological agents. Compaction of soil needs to be avoided as it hinders root growth and favors diseases caused by retention of excess soil moisture. Raised beds should be preferred for better drainage. Soil should be tested for nutrient status and nematode incidence before sowing a crop. The historical knowledge on outbreak of soil-borne disease is helpful for predicting the possible problems in the future</p>

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension service providers, agro-dealers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days. • Farmer training • Agricultural shows and exhibitions as well as farmer to farmer training. • Farmer Field and Business Schools • Agriculture innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Collaboration between all partners. • Adequate facilitation: funds, logistics (transport) • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • MoALFC-Extension Service to conduct extension services and farmer trainings. • Individual Farmers farmer groups/CBOs to participate in the implementation of this management practice for successful production of sweetpotato. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set by farmers in favour of current practices maybe difficult to achieve. • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness. • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Farmer participatory approach is effective. • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Partnership is important in dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination adoption and	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land and quality sweetpotato cutting than men • Women have less access to finances to purchase the required chemicals

scaling up	<p>than men</p> <ul style="list-style-type: none"> • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exists in applying the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seeds • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to information on production techniques • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Reference</p> <ul style="list-style-type: none"> • Milan Panth, Samuel C. Hassler and Fulya Baysal-Gurel (2020). Methods for Management of Soil borne Diseases in Crop Production. Tennessee State University, Department of Agricultural and Environmental Sciences, Otis L. Floyd Nursery Research Center, McMinnville, TN 37110, USA; mpanth@my.tnstate.edu (M.P.); shassler@tnstate.edu (S.C.H.)
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	
	Requires validation.
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO (FCRC Muguga) – Mr. Harun Odhiambo,
Partner organizations	<ul style="list-style-type: none"> • County and private Agricultural Extension service providers • CGIARs • Agriculture-based NGOs and FBOs.

2.7.4. Integrated Pest Management practices for sweetpotato mirids (sucking bugs)

TIMP name	Integrated Pest Management practices for sweetpotato mirids (sucking bugs).
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss due to crop infestation by the pest.
What is it? (TIMP description)	<p>Integrated pest Management (IPM) practice involves the use of a combination of biological, cultural, mechanical, host plant resistance and chemical control practices for the management of sucking bugs in sweetpotato fields.</p> <p>In IPM practices, the use of agro-chemicals is usually considered as a last</p>

	option after undertaking all the other pest control practices and realizing that the pests are still attacking the crop. The cultural practices include planting of trap crops such as bold seeded Indian mustard, regular monitoring of trap crops helps to control pests before being transferred to the main crop, use of botanicals such as Chili and neem seed and <i>Vitex negundo</i> leaf extracts. Biological control methods include spraying <i>Bacillus thuringiensis</i> (BT) and Meterhizium strains. The use of chemicals is considered to be the last option.
Justification	There has been an upward trend in the use of pesticides for the control of various pests in sweetpotatos. Once farmers spray their crop with either a pesticide or fungicide, there is usually a post-harvest interval (PHI) that must be observed before the crop is harvested. This condition is hardly observed by farmers hence most of the produce reaching the consumers has high chemical residues which is a health hazard. Adoption of IPM practices for control of pests in the fields and greenhouses will not only reduce the costs for purchase of pesticides but will also make the final produce safe for consumption. The IPM strategy could either involve the use of a single control practice such as cultural control or a combination of two or more control practices.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension service providers, agro-dealers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days. • Farmer training • Agricultural shows and exhibitions as well as farmer to farmer training. • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Collaboration between all partners. • Adequate facilitation: funds, logistics (transport) • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • MoALFC-Extension Service to conduct extension services and farmer trainings. • Individual Farmers farmer groups/CBOs to participate in the implementation of this management practice for successful production of sweetpotato. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be up scaled	Migori.
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set by farmers in favour of current practices maybe difficult to achieve. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties

	<ul style="list-style-type: none"> • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Approximately KES 30,000 per acre.
Estimated returns	Approximately KES 300,000 per acre.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women and youth have limited access to education, training and extension services than men • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in spraying the crop
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seeds • VMGs have limited access to training and extension services • VMGs have limited access to markets as they sometimes cannot travel to far regional markets due to either their sickness, disability or lack of exposure • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to information on production techniques • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in spraying the crop
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<ul style="list-style-type: none"> • Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on sweetpotato crop health management are documented. • Updated leaflets to be published
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires validation
G: Contacts	
Contacts	The Institute Director, Food Crops Research Centre – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO (FCRI) Njoro – John Ndung’u KALRO (FCRC Muguga) – Harun Odhiambo,

Partner organizations	<ul style="list-style-type: none"> • County and private Agricultural Extension service providers • CGIARs • Agriculture-based NGOs and FBOs.
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2.7.5. Management of sweetpotato weevils by use of Integrated Pest Management Practices

TIMP name	Management of sweetpotato weevils by use of Integrated Pest Management Practices.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss due to crop damage.
What is it? (TIMP description)	Integrated control practice for sweetpotato soil pests involves the use of a combination of biological, cultural, and chemical control methods in sweetpotato fields. The use of one control method alone is not effective since the pest usually buries itself underground and start feeding on the roots during the day and comes out at night to feed on the aerial parts. Cultural methods include clearing the fields of weeds and other foreign materials before application of other control measures. Biological control with biopesticides such as <i>Bacillus thuringiensis</i> may be used to control the pests. The use of chemicals is considered to be the last option.
Justification	<p>Sweetpotato weevil is often considered to be the most serious pest of sweetpotato, with reports of losses ranging from five to 97% in areas where the weevil occurs. There is a positive relationship between vine damage or weevil density, and tuber damage. The larva creates winding tunnels packed with fecal material as it feeds on tubers and grows.</p> <p>Soil pest infestations are sporadic and often associated with sections of the field that are weedy, have high amounts of organic residue, or poor drainage. Integrated Management of the pests using cultural, biological as well as chemical options is critical to ensure optimum plant population and to achieve expected yields.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension Agents (Public and Private), research organizations and universities, as well as CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days. • Farmer training • Agricultural shows and exhibitions as well as farmer to farmer training. • Farmer Field and Business Schools • Agricultura Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Requires a strong partnership between technical personnel / extension and farmers. • Availability of adequate funds to facilitate promotion. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • MoALFC-Extension Service to conduct extension services and farmer trainings.

	<ul style="list-style-type: none"> Individual Farmers farmer groups/CBOs to participate in the implementation of this management practice for successful production of sweetpotato.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> Change of mind-set in favour of recommended practices maybe difficult to achieve. Where farmers would not afford the synthetic insecticides, IPM components will be limited to cultural and biological options hence, some damage might occur on the sweetpotato crop. Applied and adaptive Research to test, validate and release improved sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness. Training farmers on how to apply crop rotation, establish repellent/trap crops and prepare botanical extracts to suppress the soil borne pests. Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 30,000 per acre
Estimated returns	KES 250,000 per acre
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> Women and youth have limited access to productive resources such as land, credit, and quality seeds than men Women and youth have limited access to education, training and extension services than men Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> Opportunities for youths exists in spraying the crop
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to productive resources such as land, credit, and quality seeds VMGs have limited access to training and extension services VMGs have limited access to markets as they sometimes cannot travel to far regional markets due to either their sickness, disability or lack of exposure Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have limited access to information on production techniques There is low adoption by VMGs due lack of awareness

VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in implementing the technology
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Reference <ul style="list-style-type: none"> Milan Panth, Samuel C. Hassler and Fulya Baysal-Gurel (2020). Methods for Management of Soil borne Diseases in Crop Production Tennessee State University, Department of Agricultural and Environmental Sciences, Otis L. Floyd Nursery Research Center, McMinnville, TN 37110, USA; mpanth@my.tnstate.edu (M.P.); shassler@tnstate.edu (S.C.H.)
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires validation (Use of botanicals/plant extracts).
G: Contacts	
Contacts	The Institute Director, Food Crops Research Institute – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO (FCRI Njoro) – John Ndung’u KALRO (FCRC Muguga South) – Mr. Harun Odhiambo
Partner organizations	<ul style="list-style-type: none"> County and private Agricultural Extension service providers Agriculture-based NGOs and FBOs.

2.7.6. Control of aphids (*Aphis gossypii*, *Myzuz persicae*, *Aphis spiraecola* and *Aphis middletonii*) in sweetpotato by use of Integrated Pest Management Practices

TIMP name	Control of aphids (<i>Aphis gossypii</i>, <i>Myzuz persicae</i>, <i>Aphis spiraecola</i> and <i>Aphis middletonii</i>) in sweetpotato by use of Integrated Pest Management Practices
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss due to crop damage by the pest.
What is it? (TIMP description)	<p>Management of aphids in sweetpotato through the simultaneous application of a various options (cultural, biological and chemical). Cultivation of land in dry spell reduces the colonies of ants which always protect aphids from potential predators thus enabling them to increase in population is recommended. The use of heavy doses of highly soluble nitrogen fertilizers makes leaves tender and highly succulent and this attracts aphids. It is therefore advisable to practice split application of Nitrogen during seedling and flowering stage. Placing 1-4 sticky cards per 300 sq m field area is equally recommended. These traps should be replaced at least once a week. To make your own sticky trap, spread petroleum jelly or used motor oil on yellow plywood, 6 cm x 15 cm in size or up. Place traps near the plants but faraway enough to prevent the leaves from sticking to the board. Traps when hung should be positioned 61 cm zone above the plants. Basin/pan traps can also be used by half-filling yellow pan or basin with soapy water and placing the pan/basin close to the plant but exposed enough so that aphids will see it.</p> <p>Botanical pesticides are also effective in controlling aphid populations in sweetpotato fields. Ginger rhizome extract 50 g of ginger rhizome extracts</p>

	<p>can be made into paste, mixed with 3 litres of water 12 ml of soap and applied by spraying. Ten (10) kg of ginger is needed for 1 ha. Custard apple leaf extracts can be prepared by boiling 500 g of leaves in 2 litres of water until the remaining liquid is about ½ litre, filtered, then diluted with 10 -15 litres of water and sprayed on infested Ssweetpotato. Spray solutions such as Ammonia spray (1 part ammonia with 7 parts water) or Soap spray (2½ tablespoons of liquid soap to a gallon of water) Are equally effective.</p> <p>Promotion of insects/organisms that feed on the aphids (natural enemies) such as ladybird beetles, hover fly larvae, lacewings, spiders, damsel bugs, ground beetles, rove beetles, wasps is highly encouraged.</p> <p>Mulching sweetpotato with brightly coloured straw or plastic paper also reduces aphid infestations. Relatively safe systemic pesticides can be applied at recommended rates and intervals.</p>
Justification	<p>Both the nymphs and the adults of the sweetpotato aphid (<i>Brevicoryne brassicae</i>), pierce the plant tissues to feed on plant sap. The infected leaves become severely distorted when the saliva of aphids is injected into them. Heavily infested ones will turn yellow and eventually wilt because of excessive sap removal. The aphids' feeding on the plant causes crinkling and cupping of leaves, defoliation, and stunted growth. Aphids produce large amounts of a sugary liquid waste called honeydew. A fungus, called sooty mold, grows on honeydew deposits that accumulate on leaves and branches, turning leaves and branches black. The sooty mold coating reduces surface area of leaves exposed to ultraviolet rays thus, limiting the photosynthetic potential of leaves. The net effect of this is stunted growth, premature death of plants and poor yields.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, extension Agents (Public and Private), • Research organizations and universities, as well as CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days. • Farmer training • Agricultural shows and exhibitions as well as farmer to farmer training. • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Requires a strong partnership between technical personnel / extension and farmers. • Accessibility and cost of the practice by farmers: low-cost agricultural practices and timely application of insecticides. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination of various IPM components. • Others are CGIARs, NGOs through on-farm demonstrations; capacity building of farmers. • County governments extension personnel.
C: Current situation and future scaling up	

Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Where farmers would not afford the synthetic insecticides and raw materials for preparation of plant extracts/botanicals, IPM components will be limited to cultural measures and some yield loss may occur due to crop damage. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers on how to apply botanical pesticides and spray solutions (Ammonia and soap solutions) and promote conservation of biological agents to suppress sweetpotato aphids. • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Financial implications for the acquisition of synthetic pesticides and raw materials for preparation of plant extracts is a pre-requisite for incorporating synthetic pesticides and botanicals as part of the IPM strategy for sweetpotato aphids.
Estimated returns	Varied for food security and income from sales of surplus.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women and youth have limited access to education, training and extension services than men • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in implementing the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seeds • VMGs have limited access to training and extension services • VMGs have limited access to markets as they sometimes cannot travel to far regional markets due to either their sickness, disability or lack of exposure • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to information on production techniques • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in implementing the technology
E: Case studies/profiles of success stories	

Success stories	-
Application guidelines for users	References <ul style="list-style-type: none"> North Carolina State University, Insect and Related Pests of Vegetable Crops (edited by K. A. Sorensen and J. R. Baker): http://ipm.ncsu.edu/AG295/html/index.html
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	<ul style="list-style-type: none"> Ready for upscaling (Use of insect predators), Requires validation (use of plant extracts/botanicals) Requires more research (use of Ammonia and soap solutions),
G: Contacts	
Contacts	The Institute Director Food Crops Research Institute – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO (FCRI Njoro) – John Ndung’u, KALRO (FCRC Muguga South) – Harun Odhiambo
Partner organizations	<ul style="list-style-type: none"> Public and private extension service providers CGIARs Agriculture-based NGOs and FBOs County governments

Research gap

- Train Extension staff as Plant Doctors and Lead farmers as Plant Nurses to assist farmers in pest and disease diagnosis and management.

2.7.7. Soil steam sterilization for the management of black rot and Cercospora leaf spot diseases of sweetpotato

TIMP name	Soil steam sterilization for the management of black rot and Cercospora leaf spot diseases of sweetpotato  Soil steam sterilization process Source: Soil-steaming-steam-boiler-blog.com
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Low productivity and yield loss due to crop infection by soil borne pathogens
What is it? (TIMP description)	Soil steam sterilization is a technique to sterilize the soil by using hot steam in the open field, high tunnels or greenhouses. First applied in Germany in 1888, it was the primary method for disinfecting the field prior to the arrival of soil fumigants. Fungi, bacteria, weeds, a few viruses and nematodes can all be controlled using hot steam. This method

	involves the injection of hot water vapours in the soil using boilers and conductors. The length of time and temperature for disinfecting the pathogens may vary according to pathogen and type of soil. In a recent study, <i>R. solani</i> was eliminated by steaming trays of tobacco at 80 °C for 30 min.
Justification	Soil borne diseases are considered a major limitation to crop production. Soil borne plant pathogens such as <i>Rhizoctonia spp.</i> , <i>Fusariumspp.</i> , <i>Verticillium spp.</i> , <i>Sclerotinia spp.</i> , <i>Pythium spp.</i> , and <i>Phytophthora spp.</i> can cause 50%–75% yield loss for many crops such as wheat, cotton, sweetpotato, vegetables, fruit and ornamentals as reported to date. Soilborne plant pathogens are responsible for about 90% of the 2000 major diseases of the principal crops. They often survive for long periods in host plant debris, soil organic matter, free-living organisms or resistant structures like microsclerotia, sclerotia, chlamydospore or oospores. Accurate diagnosis of a particular disease is difficult due to the similarity in symptoms such as seedling damping-off, root blackening, root rot, stunting, wilting, yellowing, bark cracking and twig or branch dieback which in turn makes the disease harder to manage
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of the pest. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will	Migori

be upscaled	
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mindset in favour of current practices maybe difficult to achieve. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Understanding the physical and biotic environment in target ecologies; understanding community culture, preferences, and practices. • Training on IDM to increase awareness of IDM and reduce possible negative impact on the environment resulting from wrong application of IDM. • Vegetable markets are able to absorb increased supply of high-quality sweetpotato.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES. 40,000 per acre
Estimated returns	Varied for food security and income from sales of surplus.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to the required implements required for this technology • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for men and youth in the application of the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Some VMGs cannot perform the task of soil sterilization due to their physical disability • VMGs have limited access to productive resources such as the implments required for this 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	Opportunities exist for youth and those recovering from drugs exists the application of this technology
E: Case studies/profiles of success stories	
Success stories	Cases to note are individual farmers and groups sensitized on importance of field sanitation in previous projects and are now practicing it in commercial sweetpotato production in major sweetpotato growing areas.
Application guidelines for users	<p>Reference</p> <ul style="list-style-type: none"> • Milan Panth, Samuel C. Hassler and Fulya Baysal-Gurel (2020). Methods for Management of Soilborne Diseases in Crop Production Tennessee State University, Department of Agricultural and Environmental Sciences, Otis L. Floyd Nursery Research Center,

	McMinnville, TN 37110, USA; mpanth@my.tnstate.edu (M.P.); shassler@tnstate.edu (S.C.H.)	
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires validation	
G: Contacts		
Contacts	The Institute Director, Food Crops Research Institute – Njoro P. O. Box 20107, Njoro, Kenya.	
Lead organization/scientists	<ul style="list-style-type: none"> • KALRO (FCRI Njoro) John Ndung’u • KALRO (FCRC Muguga South) – Harun Odhiambo, 	
Partner organizations	<ul style="list-style-type: none"> • County and private Agricultural Extension service providers • CGIARs • Agriculture-based NGOs and FBOs. 	

2.7.8. Management of foliar diseases (*Alternaria* leaf spot and *Cercospora* leaf spot) of sweetpotato by use of integrated disease management practices

TIMP name	Management of foliar diseases (<i>Alternaria</i> leaf spot and <i>Cercospora</i> leaf spot) of sweetpotato by use of integrated disease management practices.	
Category (i.e. technology, innovation or management practice)	Management practice	
A: Description of the technology, innovation or management practice		
Problem addressed	Yield loss due to crop damage.	
What is it? (TIMP description)	Integrated control practice for sweetpotato foliar involves the use of a combination of biological, cultural, and chemical control methods in sweetpotato fields. The use of one control method alone is not effective since the pest usually buries itself underground and start feeding on the roots during the day and comes out at night to feed on the aerial parts. Cultural methods include clearing the fields of weeds and other foreign materials before application of other control measures. Biological control with biopesticides such as <i>Bacillus thuringiensis</i> may be used to control the diseases. If these methods are found to be ineffective, then the chemical control method could be used by application the relatively safe fungicides with strict adherence to manufacturer’s instructions.	
Justification	Alternaria leaf spot and Cercospora leaf spot diseases mainly spread on the leaf surfaces hence, reducing the crop’s ability to manufacture food by photosynthesis. As a result, stunted growth, defoliation and death may occur leading to massive losses.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Farmers, extension Agents (Public and Private), research organizations and universities, as well as CGIARs.	
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days. • Farmer training • Agricultural shows and exhibitions as well as farmer to farmer training. • Farmer Field and Business Schools • Agriculture Innovation Platforms 	
Critical/essential factors for	<ul style="list-style-type: none"> • Requires a strong partnership between technical personnel / extension 	

successful promotion	<p>and farmers.</p> <ul style="list-style-type: none"> • Availability of adequate funds to facilitate promotion. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • MoALFC-Extension Service to conduct extension services and farmer trainings. • Individual Farmers farmer groups/CBOs to participate in the implementation of this management practice for successful production of sweetpotato.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set in favour of recommended practices maybe difficult to achieve. • Where farmers would not afford the synthetic insecticides, IPM components will be limited to cultural and biological options hence, some damage might occur on the sweetpotato crop. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness. • Training farmers on how to apply crop rotation, establish repellent/trap crops and prepare botanical extracts to suppress the foliar diseases • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 30,000 per acre
Estimated returns	KES 200,000 per acre
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women and youth have limited access to education, training and extension services than men • Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in spraying the crop
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and quality seeds • VMGs have limited access to training and extension services

	<ul style="list-style-type: none"> • VMGs have limited access to markets as they sometimes cannot travel to far regional markets due to either their sickness, disability or lack of exposure • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to information on production techniques • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in spraying the crop
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Reference</p> <ul style="list-style-type: none"> • Ravi Shankar, Seema Harsha, Raj Bhandary (2014). A Practical Guide to Identification and Control Sweetpotato Diseases TROPICA SEEDS PVT LTD No 54, South End Road, 1st Floor, Nama Aurore Building, Basavangudi, Bangalore 560004 INDIA
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, Food Crops Research Institute – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO (FCRI Njoro) – John Ndung’u KALRO (FCRC Muguga South) – Harun Odhiambo
Partner organizations	<ul style="list-style-type: none"> • County and private Agricultural Extension service providers • CGIARs • Agriculture-based NGOs and FBOs.

2.7.9. Scouting for timely identification and control of sweetpotato pests

TIMP name	Scouting for timely identification and control of sweetpotato pests.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Limited awareness by farmers on the need to undertake scouting for pest attack in their fields.
What is it? (TIMP description)	Scouting techniques and frequency to determine the presence of the different types of pests, their respective population and damage in order to make a decision on the control measures to be undertaken.
Justification	Most farmers spray pesticides indiscriminately in sweetpotato crop. This is not only uneconomical but also destructive to the environment and at the same time kills the beneficial insects. Scouting involves regular monitoring the incidences of pest damage to crops. The purpose is to gain a good understanding of the pests, weed and beneficial insect activity in your crop. Effective monitoring includes assessing the number of plants infected as well as the beneficial insects in a crop together with the incidences of diseases and weeds. Recording this information and any control actions taken, will help to better understand your crop management practices over time. Scouting has to be done on a regular

	basis so that appropriate remedial measures are undertaken timely hence reducing crop losses as well as saving on the costs of chemicals.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension service providers, agro-dealers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days. • Farmer training • Agricultural shows and exhibitions as well as farmer to farmer training. • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Collaboration between all partners. • Adequate facilitation: funds, logistics (transport) • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • MoALFC-Extension Service to conduct extension services and farmer trainings. • Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for sweetpotato production. • Universities to develop the technologies and conduct ToTs. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set in favour of current practices maybe difficult to achieve. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness. • Establish sweetpotato innovation platforms.
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Approximately KES 400 per day for 4 months.
Estimated returns	KES 250,000 per acre.

Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to agricultural information, technology and knowledge than men • All gender categories can participate in field scouting
Gender related opportunities	<ul style="list-style-type: none"> • The technology is acceptable and easy to upscale by the various gender categories • Employment opportunities exist for youths in scouting
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge than men • The VMGs can easily participate in crop scouting once sensitized and this validates their inclusion into the production of sweetpotato.
VMG related opportunities	<ul style="list-style-type: none"> • Increased production due to limited disease attack will lead to increased consumption and utilization of sweetpotato and hence improved health of VMGs • Scouting for sweetpotatoes diseases can easily be undertaken by youths and other VMGs and hence lead to a reduction in costs for pesticides.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<ul style="list-style-type: none"> • Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on sweetpotato crop health management are documented. • Updated leaflets to be published
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	
	Ready for upscaling.
G: Contacts	
Contacts	The Institute Director, Food Crops Research Institute – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO (FCRI Njoro) – John Ndung’u KALRO (FCRC Muguga) – Harun Odhiambo
Partner organizations	<ul style="list-style-type: none"> • County and private Agricultural Extension service providers • CGIARs • Agriculture-based NGOs and FBOs.

2.7.10. Sweetpotato-legume crop rotation program for the management of rhizoctonia stem canker and stem blight diseases of sweetpotato

TIMP name	Sweetpotato-legume crop rotation program for the management of rhizoctonia stem canker and stem blight diseases of sweetpotato.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Increased use of pesticides for the control of various pests in sweetpotato fields.
What is it? (TIMP description)	This is a crop rotation program legume crops such as beans, green grams, garden pea, soy beans, Bambara nuts, pigeon pea and groundnuts are rotated with sweetpotato in a sequence. Legumes and sweetpotato belong to different taxonomic groupings (families) and are infected by different diseases. As such, this rotation program breaks the disease cycle and helps to reduce disease inoculum in the soil.
Justification	Crop rotation program involving sweetpotato and legumes will not only

	help in the management of these diseases but also limit exposure of farmers and consumers to agro-chemical related hazards. It also enhances soil fertility due to nitrogen fixation into the soil by rhizobium bacteria hosted in the root nodules. Further, conservation of soil biodiversity is also achievable using this management practice.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Commercial sweetpotato nursery operators • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of the diseases. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	All counties with suitable agro-ecological settings for sweetpotato production.
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set in favour of current practices maybe difficult to achieve. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-

Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES. 60,000 per acre
Estimated returns	KES. 350,000 per acre.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land, and credit • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Women and children are the main sources of labour. Reduced workload of weeding is likely to directly impact positively on women and school going children.
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land and credit • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Increased production will improve food and nutrition security and economic empowerment of VMGs
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on approved sweetpotato pest management products.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, Food Crops Research Institute – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO (FCRC Muguga) – Mr. Harun Odhiambo, KALRO (FCRI Njoro) – Mr. John Ndung'u
Partner organizations	<ul style="list-style-type: none"> • Extension service providers • CGIARs • NGOs • County governments

2.7.11. Field sanitation as a means of controlling aphids in sweetpotato fields

TIMP name	Field sanitation as a means of controlling aphids in sweetpotato fields.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	High aphid accumulation and frequent attacks to sweetpotato leading to high production costs as a result of excessive use of agrochemicals due to poor field sanitation conditions.

What is it? (TIMP description)	The TIMP involves the reduction of aphid build up in a field by observing strict sanitation procedures in sweetpotato production. This entails ensuring that the sweetpotato crop in either the open field or the greenhouse is free from weeds and the surrounding areas are also clear of weeds and other crop residues. Removal and proper disposal of infested plants or plant parts should also be done immediately.
Justification	There is an increase in production costs for sweetpotato that end up eating into the profits due to increased use of pesticides and as a result of poor sanitation conditions in the sweetpotato fields that lead to pest outbreaks. By observing proper sanitation conditions in the fields and greenhouses, the pest incidences could easily be reduced to a minimum thereby increasing the income levels of sweetpotato producers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of the pest. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mindset in favour of current practices maybe difficult to achieve. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders

Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	•
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Understanding the physical and biotic environment in target ecologies; understanding community culture, preferences, and practices. • Training on IPM to increase awareness of IPM and reduce possible negative impact on the environment resulting from wrong application of IPM. • Vegetable markets are able to absorb increased supply of high-quality sweetpotato.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES. 40,000 per acre
Estimated returns	Varied for food security and income from sales of surplus.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to inputs such as land • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	• Opportunities for youths exists in implementing the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on approved sweetpotato pest management products.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	
	Requires validation
G: Contacts	
Contacts	The Institute Director, Food Crops Research Institute – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO (FCRI Njoro) – John Ndung’u KALRO (FCRC Muguga South) – Harun Odhiambo,
Partner organizations	Extension service providers, CGIARs, NGOs, County governments

2.7.12. Sweetpotato field sanitation for the management of circular spot disease

TIMP name	Sweetpotato field sanitation for the management of circular spot disease.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	

Problem addressed	High disease-causing pathogens accumulation and frequent attacks to sweetpotato leading to high production costs as a result of excessive use of agrochemicals due to poor field sanitation conditions.
What is it? (TIMP description)	The TIMP involves the reduction of disease-causing organisms build up in a field by observing strict sanitation procedures in sweetpotato production. This entails ensuring that the sweetpotato crop is free from weeds and the surrounding areas are also clear of weeds and other crop residues. The water used for irrigation should be clean and free from disease causing pathogens. Equipment used for weeding, pruning as well as materials used for mulching should always be clean and free from disease causing organisms.
Justification	There is an increase in production costs for sweetpotato that end up eating into the profits due to increased use of fungicides and as a result of poor sanitation conditions in the sweetpotato fields that lead to disease outbreaks. By observing proper sanitation conditions in the fields, the disease incidences could easily be reduced to a minimum thereby increasing the income levels of sweetpotato producers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of the disease. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved

	<p>sweetpotato varieties</p> <ul style="list-style-type: none"> • A platform for interaction of sweetpotato value chain stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Understanding the physical and biotic environment in target ecologies; understanding community culture, preferences, and practices. • Training on IDM to increase awareness of IDM and reduce possible negative impact on the environment resulting from wrong application of IDM. • Vegetable markets are able to absorb increased supply of high-quality sweetpotato.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES. 40,000 per acre
Estimated returns	Varied for food security and income from sales of surplus.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to inputs such as land • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in implementing the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	Cases to note are individual farmers and groups sensitized on importance of field sanitation in previous projects and are now practicing it in commercial sweetpotato production in major sweetpotato growing areas.
Application guidelines for users	Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on approved sweetpotato pest management products.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	
	Requires validation
G: Contacts	
Contacts	The Institute Director, Food Crops Research Institute – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO (FCRI Njoro) – John Ndung’u KALRO (FCRC Muguga South) – Harun Odhiambo,
Partner organizations	Extension service providers, CGIARs, NGOs, County governments

2.7.13. Use of plant extracts for control of sweetpotato butterfly

TIMP name	Use of plant extracts for control of sweetpotato butterfly.
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Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss due to crop damage by pest
What is it? (TIMP description)	Use of plant extracts involves the extraction of sap from leaves of medicinal plants with insecticidal capacities for the control of sweetpotato butterfly larvae. Such plants include neem, Tithonia, tobacco, and chili plant. The extracts can be used alone or in combination so as to make them more effective and control more than one pest.
Justification	Sweetpotato butterfly larvae feed on leaves – young caterpillars feed on the upper surface, whereas older ones eat on the whole leaf except for the primary midribs. Complete defoliation may result from severe attacks. Demand for organically produced crop products has been on the increase in the recent years. These products also fetch premium prices in the market as they are free from chemical residues. Extracts from plants such as neem and mustard do not contain heavy metals and are safe to the environment. Once sprayed onto the sweetpotato crop harvesting can be done as early as the following day without having to observe the post-harvest interval.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Commercial sweetpotato nursery operators • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of the pest. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	

Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set in favour of current practices maybe difficult to achieve. • Farmers may lack technical knowledge on how to prepare and apply botanicals. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES. 60,000 per acre
Estimated returns	KES. 350,000 per acre.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to inputs such as land • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in implementing the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	Efficacy trials have routinely been conducted by accredited institution such as KALRO in collaboration with PCPB
Application guidelines for users	<ul style="list-style-type: none"> • Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on approved sweetpotato pest management products. • PCPB List of Approved Pest Control Products.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	
	Requires further research
G: Contacts	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta University and JKUAT.
Lead organization/scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi,

	John Wesonga
Partner organizations	MoALFC, County governments, Universities

2.7.14. Evaluation of pesticides for effectiveness in control of Clearwing moth in sweetpotato

TIMP name	Evaluation of pesticides for effectiveness in control of Clearwing moth in sweetpotato.
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	There is lack of information by farmers and agro-dealers on the efficacy of most agro-chemicals that are in the market today. Many agro-chemical companies have manufactured different types of pesticides for control of various sweetpotato pests. However, their efficacies are not known while in some of them the information given on the labels does not seem to agree with the outcomes in the field once the pesticides are used for the control of pests. This therefore calls for an evaluation of the common pesticides in the market to determine their effectiveness.
What is it? (TIMP description)	The process will involve the purchase of the common pesticides used for the control of the economic pests for sweetpotato from the agro-dealers. The pesticides that are used for control of similar pests but manufactured by different agro-chemical companies will be procured and tested for their efficacy on the sweetpotato crop in different agro-ecological zones of the sweetpotato growing counties in the project mandate areas.
Justification	Farmers in the sweetpotato growing areas have used different kinds of pesticides for the control of various sweetpotato pests with very little success. This has led to many of them getting desperate owing to the high losses they incur in the process of sweetpotato production and resort to using acaricides meant to control ticks in cattle in the control of crop pests. This may expose the consumers of sweetpotato into high health risks.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of the pest. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties

	<ul style="list-style-type: none"> • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> •
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Understanding the physical and biotic environment in target ecologies; understanding community culture, preferences, and practices. • Training on IPM to increase awareness of IPM and reduce possible negative impact on the environment resulting from wrong application of IPM. • Vegetable markets are able to absorb increased supply of high-quality sweetpotato.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Finance for the application of various IPM components.
Estimated returns	Varied for food security and income from sales of surplus.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to inputs such as land • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in implementing the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	Efficacy trials have routinely been conducted by accredited institution such as KALRO in collaboration with PCPB
Application guidelines for	<ul style="list-style-type: none"> • Sweetpotato cultivation manual, brochure and fact sheet with detailed

users	guidelines on approved sweetpotato pest management products. • PCPB List of Approved Pest Control Products.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Kabete P. O. Box P.O. Box 14733-00800, Nairobi, Kenya.
Lead organization/scientists	<ul style="list-style-type: none"> • KALRO (FCRC Kabete) – Dr Ruth Amata • KALRO (FCRC Kabete) – Miriam J. Otipa • KALRO (FCRC Muguga) – Harun Odhiambo, • KALRO (FCRC Muguga) – Vincent Ochieng
Partner organizations	<ul style="list-style-type: none"> • Extension service providers • CGIARs • NGOs • County governments

2.7.15. Community rangeland rehabilitation to increase populations of natural enemies for pest management in sweetpotato

TIMP name	Community rangeland rehabilitation to increase populations of natural enemies for pest management in sweetpotato.
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Rangeland degradation due to overgrazing coupled with impacts of climate change. This has led to diminishing livestock feed and loss of natural resource base.
What is it? (TIMP description)	<p>Rangeland rehabilitation consists of application of a range of TIMPs with the purpose of reclaiming the productivity of the rangelands.</p> <p>The ultimate goal is to reclaim the structure and functioning from the original system.</p> <p>Examples of TIMPs include multi-purpose agroforestry species, range reseeding and soil erosion control e.t.c.</p>
Justification	<p>The rangelands cover three quarters of Kenya and underpin the livestock and wildlife industries. However, rangeland communities have low development indicators and face several growing threats.</p> <p>Severe droughts, land degradation and land subdivision have resulted in disrupted livelihoods. This has enhanced the vulnerabilities of people living in these lands.</p>
Counties where TIMPs have been promoted if any	
Counties where the TIMPs will be upscaled	Migori
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, agropastoralists,
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Demonstration, local FM • Farmer Field and Business Schools

	<ul style="list-style-type: none"> • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Timely disbursement of funds, • Buy-in of technology from farmers and stakeholders • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted	-
Counties where the TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Low or non-existent skill and technology • High costs associated with technology installation vis-à-vis longer lead time for accrued benefits • Limited supportive policies • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • County government to create an enabling policy and institutional environment for sustainable rangelands management • Increased community awareness on the benefits of rangeland rehabilitation • Lobby for increased funding for rehabilitation efforts • Increase public investment to strengthen local governance for community-based rangeland rehabilitation through revival of traditional systems • Strengthen awareness of the economic values of rangeland rehabilitation and develop markets-based incentives. • Strengthen livestock market linkages to reduce pressure on the range resources. • Establish sweetpotato innovation platforms.
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • There are greater benefits from rehabilitation, though this takes a longer time • Community awareness on the benefits of rehabilitation increases support or buy-in • Policies that support and enforce rehabilitation in communal and tenure systems are key for success
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Supporting environmental policies • Capacity building on rangeland rehabilitation TIMPs • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Partnership is important in dissemination and adoption and this can be facilitated through innovation platforms
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Depends on various factors like level of degradation and the TIMPs to be

	deployed
Estimated returns	Depends on various factors like TIMPs deployed and outputs from the rehabilitation efforts
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women may have less access to inputs such as land • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in implementing the technology
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	This will depend on the level of degradation and the TIMP being deployed
F: Status of TIMP readiness (1-Ready for upscaling; 2- Requires validation; 3-Requires further research	Requires further research
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO, M. Okoti, J. Mwaure
Partner organizations	County government, Public Private Partnerships (PPP)

Research gaps

- Assessment of rangeland ecosystem change
- Estimation of the potential carbon sequestration or GHG reduction in rangelands management
- Economics of rangeland rehabilitation.
- Assessment of future demand for forage, fuelwood, agriculture, or other uses from rangeland ecosystems

2.7.16. Field sanitation as a means of controlling *Alternaria* leaf spot disease incidences

TIMP name	Field sanitation as a means of controlling <i>Alternaria</i> leaf spot disease incidences
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	High disease-causing pathogens accumulation and frequent attacks to sweetpotato leading to high production costs as a result of excessive use of agrochemicals due to poor field sanitation conditions.
What is it? (TIMP description)	The TIMP involves the reduction of disease-causing organisms build up in a field by observing strict sanitation procedures in sweetpotato production. This entails ensuring that the sweetpotato crop in either the open field of the greenhouse is free from weeds and the surrounding areas

	are also clear of weeds and other crop residues. The water used for irrigation should be clean and free from disease causing pathogens. Equipment used for weeding, pruning as well as materials used for mulching should always be clean and free from disease causing organisms.
Justification	There is an increase in production costs for sweetpotato that end up eating into the profits due to increased use of fungicides and as a result of poor sanitation conditions in the sweetpotato fields that lead to disease outbreaks. By observing proper sanitation conditions in the fields, disease incidences could easily be reduced to a minimum thereby increasing the income levels of sweetpotato producers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of the disease. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind set in favour of current practices maybe difficult to achieve. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and

	<p>economic analysis to convince them on cost effectiveness</p> <ul style="list-style-type: none"> • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Understanding the physical and biotic environment in target ecologies; understanding community culture, preferences, and practices. • Training on IDM to increase awareness of IDM and reduce possible negative impact on the environment resulting from wrong application of IDM. • Vegetable markets are able to absorb increased supply of high-quality sweetpotato.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES. 40,000 per acre
Estimated returns	Varied for food security and income from sales of surplus.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to inputs such as land • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in implementing the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	Cases to note are individual farmers and groups sensitized on importance of field sanitation in previous projects and are now practicing it in commercial sweetpotato production in major sweetpotato growing areas.
Application guidelines for users	<p>Reference</p> <ul style="list-style-type: none"> • Milan Panth, Samuel C. Hassler and Fulya Baysal-Gurel (2020). Methods for Management of Soil borne Diseases in Crop Production Tennessee State University, Department of Agricultural and Environmental Sciences, Otis L. Floyd Nursery Research Center, McMinnville, TN 37110, USA; mpanth@my.tnstate.edu (M.P.); shassler@tnstate.edu (S.C.H.)
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	
	Requires validation
G: Contacts	
Contacts	The Centre Director, Muguga South, P. O. Box 30148-00100, Nairobi
Lead organization/scientists	<ul style="list-style-type: none"> • KALRO (FCRC Muguga) – Mr. Harun Odhiambo, • KALRO (FCRC Muguga) – Mr. James Ndambuki • KALRO (FCRI Njoro) – Mr. John Ndung'u
Partner organizations	<ul style="list-style-type: none"> • Extension service providers • CGIARs • NGOs • County governments

2.7.17. Anaerobic Soil Disinfection (ASD) for the management of soil borne pathogens of sweetpotato

TIMP name	Anaerobic Soil Disinfection (ASD) for the management of soil borne pathogens of sweetpotato
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low productivity and yield loss due to crop infection by soil borne pathogens
What is it? (TIMP description)	Anaerobic soil disinfestation (ASD), also known as biological soil disinfestation is a process of disinfecting the soil by making it anaerobic using easily decomposable amendments such as rice bran, fresh crop residues and soy bean flour, covering it with plastic film, and irrigating to saturation. ASD can be applied in open field, greenhouses and even soilless systems. The soil amendments used in ASD provide the substrate for rapid microbial growth. The irrigation and plastic mulch followed by soil amendment decomposition restricts the gaseous exchange between the soil and atmosphere, thus creating anaerobic decomposition of the added amendments. The anaerobic decomposition of the soil amendment allows many toxic substances to accumulate in the soil such as acetic acid, butyric acid, and other volatiles which can reduce the soilborne plant pathogens. Many soil borne plant diseases such as Fusarium wilt (<i>F. oxysporum</i>), southern blight (<i>S. rolfsii</i>), Verticillium wilt (<i>V. dahliae</i>), bacterial wilt (<i>Ralstonia solanacearum</i>) and root-knot nematodes (<i>Meloidogyne spp.</i>) are found to be susceptible against ASD. <i>Agrobacterium tumefaciens</i> and <i>P. ultimum</i> have been successfully controlled using the ASD technique
Justification	As ASD has already proved to be effective against many soilborne plant pathogens, this technique could be a very useful method for the growers to manage the soil borne diseases while improving the soil conditions. There is an increase in production costs for sweetpotato that end up eating into the profits due to increased use of fungicides. ASD can also increase the beneficial microbes in the soil, thus helping to control the harmful soil borne pathogens by creating competition.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Farmer Field and Business Schools • Agriculture Innovation Platforms

Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of these diseases. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set in favour of current practices maybe difficult to achieve. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	•
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Understanding the physical and biotic environment in target ecologies; understanding community culture, preferences, and practices. • Training on IDM to increase awareness of IDM and reduce possible negative impact on the environment resulting from wrong application of IDM. • Vegetable markets are able to absorb increased supply of high-quality sweetpotato.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES. 60,000 per acre
Estimated returns	Varied for food security and income from sales of surplus.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to inputs such as land • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	• Opportunities for youths exists in implementing the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities

	<ul style="list-style-type: none"> • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	Cases to note are individual farmers and groups sensitized on importance of field sanitation in previous projects and are now practicing it in commercial sweetpotato production in major sweetpotato growing areas.
Application guidelines for users	<p>Reference</p> <ul style="list-style-type: none"> • Milan Panth, Samuel C. Hassler and Fulya Baysal-Gurel (2020). Methods for Management of Soilborne Diseases in Crop Production Tennessee State University, Department of Agricultural and Environmental Sciences, Otis L. Floyd Nursery Research Center, McMinnville, TN 37110, USA; mpanth@my.tnstate.edu (M.P.); shassler@tnstate.edu (S.C.H.)
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires validation
G: Contacts	
Contacts	The Centre Director, Muguga South, P. O. Box 30148-00100, Nairobi
Lead organization/scientists	KALRO (FCRC Muguga) – Mr. Harun Odhiambo,
Partner organizations	Extension service providers, CGIARs, NGOs, County governments

2.7.18. Crop rotation as a means of controlling stem blight disease in sweetpotato

TIMP name	Crop rotation as a means of controlling stem blight disease in sweetpotato.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Disease build-up in as a result of continuous cultivation of sweetpotatos in the same field or greenhouse for a long period of time.
What is it? (TIMP description)	The TIMP involves the reduction of disease pathogens build up in a field or greenhouse by observing strict crop rotation procedures in sweetpotato production. The rotation should be done in such a way that the crop that follows the sweetpotato after harvest is of a different family. Suitable rotation crops include cereals, garlic, coriander, amaranth as well as leguminous crops.
Justification	Sweetpotato is usually affected by a number of diseases as they grow. The disease-causing organisms usually remain in the field with the crop residues and in the soil after the crop is harvested. Once a new crop of sweetpotato is planted in the same field, the diseases will quickly multiply and start infecting the plants. By practicing crop rotation, the plant pathogens will lack substrate and will in the long run die. This will help in reducing their populations after a different crop that is not related to sweetpotato is planted in the following season.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private)

	<ul style="list-style-type: none"> • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of the disease. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind set in favour of current practices maybe difficult to achieve. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness. • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Farmer participatory approach is effective. • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform. • Partnership is important in dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES. 40,000 per acre
Estimated returns	KES. 350,000 per acre

Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to land for sweetpotato cultivation than men • Women and youth may also have limited access to finances to buy the required inputs such as seeds than men. • Women may not have time and mobility to attend extension activities far from home or held at times when they are performing other roles e.g. domestic • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for women exist in production of the crop through crop rotation for improved yields • Cash generated from sweetpotato production by the various gender categories can be ploughed back in other agricultural enterprises such as other crops or livestock farming.
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs may have less access to markets • VMGs have limited access to land for sweetpotato cultivation than men • VMGs may have less access to credit • High illiteracy level of the VMGs makes them unable to read the dissemination documents and other materials
VMG related opportunities	Increased production will lead to increased consumption and utilization of sweetpotatoes hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	Cases to note are individual farmers and groups sensitized on importance of crop rotation in previous projects and are now practicing it in commercial sweetpotato production in major sweetpotato growing areas.
Application guidelines for users	Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on approved sweetpotato pest management products.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	
	Requires validation
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	<ul style="list-style-type: none"> • KALRO (FCRC Muguga) – Dr David Lelgut • KALRO (FCRC Muguga) – Mr. Harun Odhiambo • KALRO (FCRC Muguga) – Mr. Vincent Ochieng
Partner organizations	<ul style="list-style-type: none"> • Extension service providers • CGIARs • NGOs • County governments

2.7.19. Evaluation of fungicides for effectiveness in the control of blue mold, dry and end rots in sweetpotato

TIMP name	Evaluation of fungicides for effectiveness in the control of blue mold, dry and end rots in sweetpotato
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Presence of many and different types of fungicides in the market that are

	manufactured for use by sweetpotato farmers for the control of diseases but their levels of efficacy is not known or is not corresponding to the instructions given in the label.
What is it? (TIMP description)	The TIMP involves sourcing of the different disease control chemicals manufactured by the different agrochemical companies and evaluating them for their effectiveness in controlled research trials.
Justification	Sweetpotato farmers have faced challenges related to recommended chemicals that are not effective in disease control. Most farmers end up purchasing more than one chemical for use in the control of the same disease. This leads to an increase in production costs as well as a destruction of the environment through excessive use of agro-chemicals. There is need to determine efficacy of these products continually to ensure that only products with good efficacy are recommended.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of the disease. • Adequate facilitation: funds, logistics (transport) • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set in favour of current practices maybe difficult to achieve. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties

	<ul style="list-style-type: none"> • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness • On farm trials • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Farmer participatory approach is effective. • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform. • Partnership is important in dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	Organized collective marketing channels critical for benefits to be derived from practice
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to inputs such as land • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for youths exists in implementing the TIMP
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the TIMP
E: Case studies/profiles of success stories	
Success stories	Cases to note are individual farmers and groups sensitized on importance of crop rotation in previous projects and are now practicing it in commercial sweetpotato production in major sweetpotato growing areas.
Application guidelines for users	Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on approved sweetpotato pest management products.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	<ul style="list-style-type: none"> • KALRO (FCRC Kabete) – Dr Ruth Amata • KALRO (FCRC Muguga) – Harun Odhiambo,
Partner organizations	<ul style="list-style-type: none"> • Extension service providers • CGIARs • NGOs • County governments

Research gap

- Evaluation of WHO recommended fungicides for suitability in management of fungal plant diseases across different agroecological zones.

2.7.20. The use of resistant sweetpotato varieties in managing Sweetpotato Chlorotic Stunt (SPCSV), Sweetpotato Feathery Mottle Virus (SPFMV) and sweetpotato Latent Virus (SPLV) diseases

TIMP name	The use of resistant sweetpotato varieties in managing Sweetpotato Chlorotic Stunt (SPCSV), Sweetpotato Feathery Mottle Virus (SPFMV) and sweetpotato Latent Virus (SPLV) diseases.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> • Yield loss due to high incidence of disease. • Indiscriminate use of synthetic chemical pesticides
What is it? (TIMP description)	<p>Resistant varieties have inherent genetic capacity to tolerate and/or resist rind necrosis. A variety with resistance to a specific pathogen does not require additional application of chemical pesticides to manage the specific diseases.</p> <p>A disease resistant variety may also possess' other attributes such as high yield potential and early maturity. Varieties with tolerance to different pests and diseases should be promoted in different regions where sweetpotato are grown. When purchasing sweetpotato seeds, farmers should ask for varieties that are tolerant to this disease prevalent in their regions. Growers can use codes on the labels to establish the tolerance levels of different varieties.</p>
Justification	Sweetpotato is an important crop for food, nutrition and income security in Kenya. A wide range of pests and diseases limit production. Most farmers have to rely on chemical pesticides to control pests and diseases. In some areas farmers are compelled to abandon fields due to pests and diseases. Resistant varieties offer a sustainable and environment friendly strategy for pests and disease control due to their ability to withstand the injurious effects of pests.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Farmer Field and Business Schools • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended

	<p>practices resulting to effective control of the pest.</p> <ul style="list-style-type: none"> • Adequate facilitation: funds, logistics (transport) • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • NARIGP, and relevant universities/research institutions will conduct research trials on performance of varieties under different agro-ecological conditions and pests/disease hotspots. • The universities will further conduct research on pest/ disease distribution to guide dissemination of resistant varieties. • County governments, farmers groups/CBOs, NGOs, private nursery operators will implement extension.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of funds to purchase certified sweetpotato seeds • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Stakeholder partnership in acquiring certified sweetpotato seeds. • Training and demonstration of technology. • Economic analysis to convince them on cost effectiveness. • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Favourable climatic conditions for sweetpotato production. • Sustained market demand for sweetpotato.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Varied with variety
Estimated returns	KES. 350,000 per acre
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to the required quality resistant sweetpotato cuttings • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Employment opportunities exist for men and youth raising quality resistant varieties
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities exist for youth and those recovering from drugs exists the application of this technology
E: Case studies/profiles of success stories	

Success stories	-
Application guidelines for users	Production guidelines are provided by seed merchants and seed companies.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO (FCRC Muguga) – Mr. Harun Odhiambo,
Partner organizations	Extension service providers, CGIARs, NGOs, County governments

Research gaps

- Evaluation of performance of resistant varieties under different agro-ecological conditions and disease/pest hotspots
- Development of pest / disease distribution maps to guide dissemination of resistant varieties in Kenya.
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2.7.21. The use of Biocontrol agents in managing whiteflies in sweetpotato

TIMP name	The use of Biocontrol agents in managing whiteflies in sweetpotato
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss due to high incidence of pests and disease. Indiscriminate use of synthetic chemical pesticides
What is it? (TIMP description)	Bio-control is an approach that uses living organisms or their products to suppress pests/ pathogens and detrimental effects on cultivated crops. Bio-control is environment friendly and a more sustainable method compared to chemical products. The targeted pests (whiteflies) may depend on weeds as alternative hosts for the continuity of their generations. Bio-pesticides have various types of formulations and they can be applied using various methods including spraying, granule incorporation into soil, drenching, dipping or smearing. For whitefly control, predators are released into the fields where the pests occur and once established, they can sustain their populations over extended periods of time. Depending on the target pest, bio-control products can be applied at different stages of the sweetpotato crop growth.
Justification	Sweetpotato is an important crop for food, nutrition and income security in Kenya. Whiteflies can limit sweetpotato yields by sucking cellular sap from leaves while transmitting viruses which impair plant physiological processes that support growth and development. Most farmers prefer to use pesticides for pest control but these are costly, and can be harmful to the environment and people. In addition, inappropriate use of pesticides leaves residues on sweetpotato fruits, which lowers their quality and can lead to pests becoming resistant. Biocontrol products are a suitable and more environment friendly alternative for pest control.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers

	<ul style="list-style-type: none"> • Agroveter dealers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer field schools • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Sustained demand for effective disease control methods • Favorable climatic conditions for sweetpotato production • Collaboration between all partners • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • NARIGP, relevant universities and research institutions will conduct research trials on biopesticide use and their effectiveness under different agro-ecological conditions and whitefly hotspots. • County governments, farmers groups/CBOs, NGOs, private nursery operators will implement extension.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Perception of biopesticides being slow acting. • Some bio-products cost more than synthetic products • Lack of funds to purchase bio-pesticides. • Nonexistent distribution network bio-pesticides • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training and demonstration on bio-pesticide use. • Economic analysis to convince growers on cost effectiveness. • Avail affordable effective biocontrol products • Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • -
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Guidelines on pesticide residue limits for sweetpotato. • Favorable climatic conditions for sweetpotato production. • Sustained market demand for high quality sweetpotato fruits.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Varies with bio-pesticide product.
Estimated returns	KES. 350,000 per acre

Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to finances to purchase the required chemicals than men • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in spraying the crop
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for unemployed youths and those recovering from drugs exists in spraying the crop
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Production guidelines are provided by biopesticide producers.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	<ul style="list-style-type: none"> • KALRO (FCRC Muguga) – Mr. Harun Odhiambo, • KALRO (FCRC Muguga) – Mr. Vincent Ochieng
Partner organizations	<ul style="list-style-type: none"> • Extension service providers • CGIARs • NGOs • County governments

Research gaps

- 1. Evaluate opportunities to integrate bio-control products to existing pest control strategies.
- 2. Modelling climate changes and their potential impact on effectiveness of bio-control products

2.7.22. Evaluation of pesticides for effectiveness in control of sweetpotato weevils

TIMP name	Evaluation of pesticides for effectiveness in control of sweetpotato weevils.
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	<p>There is lack of information by farmers and agro-dealers on the efficacy of most agro-chemicals that are in the market today.</p> <p>This therefore calls for an evaluation of the common pesticides in the market to determine their effectiveness.</p>
What is it? (TIMP description)	<p>The process will involve the purchase of the common pesticides used for the control of the economic pests for sweetpotato from the agro-dealers.</p> <p>The pesticides that are used for control of similar pests but manufactured</p>

	by different agro-chemical companies will be procured and tested for their efficacy on the sweetpotato crop in different agro-ecological zones of the sweetpotato growing counties in the project mandate areas.
Justification	<p>Many agro-chemical companies have manufactured different types of pesticides for control of white fringed beetles and cucumber beetles. However, their efficacies are not known while the information given on the labels of some pesticides does not seem to agree with the outcomes in the field once the pesticides are used for the control of pests.</p> <p>Farmers in the sweetpotato growing areas have used different kinds of pesticides for the control of various sweetpotato pests with very little success.</p> <p>This has led to many of them getting desperate owing to the high losses they incur in the process of sweetpotato production and resort to using acaricides meant to control ticks in cattle in the control of crop pests such as white fringed beetles and cucumber beetles.</p> <p>This has exposed the consumers of sweetpotato into high health risks.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Agriculture Innovation Platforms • Farmer Field and Business Schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps to upscale the management practice since their active participation enhances uptake of the recommended practices resulting to effective control of sweetpotato pests. • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers (Public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers. • NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mind-set in favour of current practices maybe difficult to

	<p>achieve.</p> <ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums. • Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness.
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • -
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Understanding the physical and biotic environment in target ecologies; understanding community culture, preferences, and practices. • Training on IPM to increase awareness of IPM and reduce possible negative impact on the environment resulting from wrong application of IPM. • Vegetable markets are able to absorb increased supply of high-quality sweetpotato.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Finance for the application of various IPM components.
Estimated returns	Varied for food security and income from sales of surplus.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to inputs such as land • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in implementing the technology
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in applying the technology
E: Case studies/profiles of success stories	
Success stories	Efficacy trials have routinely been conducted by accredited institution such as KALRO in collaboration with PCPB
Application guidelines for users	<ul style="list-style-type: none"> • Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on approved sweetpotato pest management products. • PCPB List of Approved Pest Control Products.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	<ul style="list-style-type: none"> • KALRO (FCRC Muguga) – Mr. Harun Odhiambo, • KALRO (FCRC Muguga) – Mr. Vincent Ochieng
Partner organizations	• Extension service providers, CGIARs, NGOs, County governments

Research gap

- Determination of pesticide suitability for effective control of white fringed beetles and cucumber beetles across the sweetpotato producing regions of Kenya

2.7.23. Quarantine and movement restriction for management of leaf spot diseases and mildews in sweetpotato

TIMP name	Quarantine and movement restriction for management of leaf spot diseases and mildews in sweetpotato.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	High incidences of pests and diseases in sweetpotato production systems.
What is it? (TIMP description)	This entails restriction of access to and movement within production areas. Strict procedures involving disinfection and cleaning are followed before access to production sites. Movement of animals into production site is eliminated and tools and other equipment and implements are cleaned before use in production places.
Justification	This is a preventive method that minimizes pest infestation. It is a first line of defence against pests that ensures minimal costs of dealing with disease outbreak. It contributes to product safety through minimal use of pesticides. Due to low pesticide usage production costs are also lower.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Agroveterinarians • Commercial vegetable nurseries • Extension Agents (Public and Private) • Research organizations and universities • CGIARs
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Extension publications • On-farm demonstrations • Farmer field days • Farmer Field and Business Schools • Farmer training • Agricultural shows and exhibitions • Farmer to farmer training • Agriculture Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Collaboration between all partners • Adequate facilitation: funds, logistics (transport) • Applied and adaptive Research to test, validate and release improved sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension service providers: County extension staff, farmer groups and CBOs for promoting the management practice. • Student interns for sensitizing farmers and building their capacity. • Media for creating awareness
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be upscaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Capital cost in setting up structures for restricting and controlling

	<ul style="list-style-type: none"> movement may be prohibitive for many farmers Limited access to credit for farmers Applied and adaptive Research to test, validate and release improved sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Linking farmers to funding sources Establish sweetpotato innovation platforms
Lessons learnt in upscaling, if any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> Guidelines on pesticide residue limits for sweetpotato. Favorable climatic conditions for sweetpotato production. Sustained market demand for high quality sweetpotato fruits.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> Women may have less access to inputs such as land Women and youth have limited access to education, training and extension services than men Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in for all the various gender categories in implementing the management practice
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for the VMGs in implementing the management practice
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Brochure and fact sheet with detailed guide on seed dressing documented
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	
	Requires validation
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya.
Lead organization/scientists	KALRO (FCRC Muguga) – Mr. Harun Odhiambo,
Partner organizations	Extension service providers, CGIARs, NGOs County governments

Research gaps

- Evaluation of pest/ pathogen diversity/ biotypes and distribution in sweetpotato growing regions.
- Modelling the effect of climate changes on pathogen populations and their distribution as a predictor of future pesticide use trends.

2.7.24. Safe use of pesticides

TIMP Name	Safe use of pesticides
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Category (technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Excessive pesticides application to crops, use of pesticides for spraying crops without wearing the right spraying gear, storage of pesticides in non-designated stores, spraying against the wind direction and use of pesticides without following the guidelines given in the labels.
What is it? (TIMP description)	Capacity building of farmers, crop protection teams and on safe handling and use of pesticides right from transportation from the agro-dealers to storage in their houses, mixing procedures and their application in the field in order to ensure safety of the crop, the person handling them and the environment at large.
Justification	Cases of improper use of pesticides are very common in most of the areas where sweetpotato are grown. There have been incidences of excessive use, improper handling that leads to the spray attendants inhaling the chemicals in the process of spraying, use of inappropriate spray equipment that leads to leakages and thereby exposing the handlers to health risks as well as contamination of the water bodies. Most of these irregularities can easily be corrected through sensitization and capacity building forums so as the end users can be made aware of the best practices that should be used when handling pesticides.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers,
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ Shows, Trade fairs Farmer Field and Business Schools Agriculture Innovation Platforms
Most effective approach	Farmer participatory demonstrations Farmer Field and Business Schools
Critical/essential factors successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport) Applied and adaptive Research to test, validate and release improved sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	MoALFC-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for sweetpotato production, NARIGP and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
Counties where technology already being promoted if any	-

Counties where TIMPS will be upscaled	Migori
Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve Applied and adaptive Research to test, validate and release improved sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders
Suggestions for addressing	Capacity building and sensitization forums Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on costeffectiveness Establish sweetpotato innovation platforms
Lessons learnt in upscaling if any	-
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	Women and youth have limited access to education, training and extension services than men Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in for all the various gender categories in implementing the management practice
VMG issues and concerns development, dissemination, adoption and scaling up	VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for the VMGs in implementing the management practice
E: Case studies/profiles of success stories	
Success stories	Cases to note are individual farmers and groups who are engaged in commercial sweetpotato business in major sweetpotato growing areas who practice safe use of pesticides aftersensitization in various forums and past research projects
Application guidelines for users	Sweetpotato cultivation manual, brochure and fact sheet with detailed guidelines on sweetpotato crop protection
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Ready for upscaling;
F: Contacts	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta, University and JKUAT.
Lead organization/scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALFC, County governments, Universities

2.7.25. Integrated management of Root Knot and Dagger Nematodes





TIMP Name	Integrated management of Root Knot and Dagger Nematodes.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low sweetpotato production due to pests infestation
What is it? (TIMP description)	These are minute worm-like pests that suck nutrients from roots, causing gradual decline in sweetpotato yields. It is transmitted through infested/contaminated planting materials, soil, water, farm tools/machinery, foot wear/feet of farm workers
Justification	Potato is among the key food security crops alongside rice, sweetpotato, wheat and beans identified under the big four agenda. Increasing population pressure demand more food to eat, with changing habits to potato and potato products, hence offering ready market Potato has a short cropping cycle, high water use efficiency leading to high production per unit area compared to other food crops; makes it suitable as a climate smart crop High production within a short period of time, can be cropped several seasons per year These nematodes have the potential of devastating the sweetpotato crop, which could render the country food insecure hence not attaining big four agenda, Kenya Vision 2030 and SGDs.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	companies and SMEs Other research organizations/institutions (universities) Agro-input sweetpotato farmers Seed producing dealers
Approaches used in dissemination	Farmer Participatory Evaluation exercises On-farm demonstration Field days Agricultural shows MoALFC/Extension officers Mobile phone text initiative Farmer to farmer peer learning Mass media – e.g. Mkulima programme, Smart farmer, Seeds of Gold Workshops Seminars, Meetings, trainings Promotional materials (posters/brochures/leaflets) Social platform – twitter, google apps, Facebook
Critical/essential factors for successful promotion	Capacity building of farmers, extension officers and other stakeholder on integrated management practices of root knot and dagger nematodes Establishment of FFBS funding by government to promote production and distribution of certified seed potato at farm level
Partners/stakeholders for scaling up and their roles	MoALFC, Livestock, Fisheries & Irrigation (MoALFC) Extension and Capacity Building ICIPE (International Centre for Insect Physiology and Ecology)– collaborative research on crop protection FAO (Food and Agricultural Organization)- co-sharing of resources and


	networking and knowledge management CIGs (Common Interest Groups) backstopping the technologies at grass root levels NGOs (Non-governmental organization) (CARE Kenya): (Farmer Input Promotion)
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up-scaled	Migori
Challenges in dissemination	Big challenge between information availability and accessibility Non-exposure of the end-user to the management strategies
Recommendations for addressing the challenges	Information dissemination – Root knot and dagger nematodes integrated management strategies Scaling up participation of end-user in on-farm activities/adaptive research/extension activities Find innovations in reducing integrated management practices costs to encourage more potato production.
Lessons learnt in up-scaling if any	-
Social, environmental, policy and market conditions necessary	Important in the local diet – Environmentally friendly resilient and climate smart. There is availability of market: domestic and regional
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination, adoption and upscaling	Women and youth have limited access to productive resources such as land and quality seeds than men Women have less access to finances to purchase the required chemicals than men Women and youth have limited access to education, training and extension services than men Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Opportunities for youths exists in spraying the crop
VMG issues and concerns in development, dissemination, adoption and upscaling	VMGs have limited access to productive resources such as land, credit, and quality seeds VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have limited access to information on production techniques There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from drugs exists in spraying the crop
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Minimize pest entry through strict adherence to regulatory and quarantine measures.

	<p>Plant certified and clean seed.</p> <p>Practice crop rotation for over 5 years with non-Solanaceous crops e.g. cereal, legumes, sweetpotato & leafy vegetables.</p> <p>Destroy all off-season Solanaceous volunteer plants.</p> <p>Minimize nematode spread by thoroughly cleaning farm tools, machinery and foot wear.</p> <p>Plough early to expose and desiccate nematodes through solar heat.</p> <p>Plant trap crops (e.g. black nightshade and eggplants) and uproot them at 5-6 weeks for safe disposal, hence reducing PCN populations.</p> <p>Incorporate Brassica residue into soil to reduce nematode levels (bio-fumigation).</p> <p>Apply neem-based pesticides or biological agents (such as Bionematon) to control nematodes</p>
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org
Lead organization/scientists	Miriam J. Otipa – KALRO (FCRC Kabete) John Ndung'u – KALRO (FCRC Njoro) Harun Odhiambo – KALRO (FCRC Muguga South)
Partner organizations	International Centre for Insect Physiology and Ecology (ICIPE) Common Interest Groups (CIGs) Bayer Crop science

2.7.26. Sweetpotato Integrated Weed Management

TIMP Name	Sweetpotato Integrated Weed Management
Crop management practices	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	<p>Different annual grass weeds and perennial weed species and poor weed management lead to yield losses and lack of profitability in sweetpotato cropping systems. Some key weed grass species including couch grass (<i>Digitaria abyssinica</i>), goose grass (<i>Eleusine indica</i>), crows foot (<i>Dactyloctenium aegyptium</i>), <i>Sateria spp.</i> Palmer amaranths (<i>Amaranthus palmeri</i>), pigweed (<i>Amaranthus spp</i>), thorn apple (<i>Datura stramonium</i>) and sedges (<i>Cyperus spp</i>) are more a challenge in sweetpotato growing fields or regions where they have succeeded because of their morphological and phenological characteristics. Competition occurs at four levels: 1) intraspecific competition between sweetpotato plants, 2) interspecific competition between sweetpotato and weed species, 3) interspecific competition between weed species and 4) intra specific competition between same weed species. These weeds compete with the crop for nutrients, soil moisture, space and sunlight and this reduces yields and profitability.</p>

			
	<p><i>Thorn apple (Datura stramonium)</i> <i>Source: Hottensiah Mwangi</i></p>	<p><i>Yellow nutsedge Cyperus esculentus)</i> <i>Source: Violet Momanyi</i></p>	
			
	<p><i>Sweetpotato crop infested with Amaranthus retroflexus</i> <i>Source : Violet Momanyi.</i></p>	<p><i>Weed free sweetpotato crop</i> <i>Source: Hottensia Mwangi</i></p>	
<p>What is it? (TIMP description)</p>	<p>Integrated Weed Management (IWM) is the management of weeds using two or more appropriate approaches including preventive, planting in a weed free prepared land, use of mulch (biodegradable or synthetic), cultural, rotation, intercropping and chemical control depending on the weed types infesting the field.</p> <p>Cultural includes transplanting rather than direct planting, proper fertilization, irrigation, use of cover crops and plastic mulch to reduce weed populations. Physical control is the removal of weeds manually or by mechanical means, such as hand weeding or mowing. In manual weeding farmers carry out manual weeding at 2-3weeks depending on the environment, weeds present, rainfall or soils. Chemical control is where appropriate recommended herbicides are applied to control weeds following the label. The weed composition needs to be identified and the data used to implement timely and the best management approach. Step one is to monitor fields and maintain records about weeds occurring in each field. Identify species and where they are likely to appear. Proper identification of species will determine management and, because one approach will be effective only on some species and not others use two or more as appropriate for a clean sweetpotato field. Knock out weeds at the right time.</p>		


	 <p>The right time to knock out weeds in young sweetpotato crop. Source: Violet Momanyi</p>
Justification	<p>Sweetpotato growers in Kenya use inappropriate manual approaches to manage the weeds. This is due to limited knowledge on weeds and weed control strategy including cover crops and herbicide. Whereas manual weeding can be effective for managing some weed species, it is time consuming and labour intensive. However manual weeding can also be ineffective especially when weeding is done under wet conditions because specific types of weeds such as <i>Commelina benghalensis</i> and <i>Portulaca oleraceae</i> get apparently disseminated and replanted through cuttings. Hence, regrowth becomes a big problem. Judicious use of herbicides integrated with cultural methods gives a promising option for weed control in sweetpotato cropping systems. Therefore there is need to apply more than one approach to manage the biodiversity of weeds.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension workers, Agrodealers
Approaches used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), Training workshops, Seminars, Meetings, Demonstrations and field days. Media (Online), manuals, pamphlets/ leaflets.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release IPM in sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Promote and train on integrated weed management (IWM). • Address environmental and safety concerns related to the use of selected herbicides • Accompany the promotion with demos and field days with farmer groups and stakeholders on the effectiveness of the various weed management options using FFSB approach. • Train users on appropriate use of herbicide and safe use. • Train stakeholders on biology of weeds and weed dynamics in cropping systems. • Farmers need training on timing with regard to conservation of biodiversity. Preserve pollinators for increased productivity of weed control.
Partners/stakeholders for scaling up and their respective roles.	MoALFC, Research partners (KALRO, County extension staff, NGOs).
C: Current situation and future scaling up	
Counties where already	Siaya, Kiambu

promoted if any	
Counties where TIMPs will be up scaled	Bungoma, Kakamega, Busia, Vihiga, Siaya, Homabay, Kisumu, Kisii, Nyamira, Migori, Kericho, Nakuru, Turkana, West Pokot, Marakwet
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders, low use of proper agronomic practices, labour intensity, high cost of herbicides, inadequate knowledge and information on which herbicides to use, when to use them and their persistence in the soil. • Myths on appropriateness of using herbicides
Suggestion for addressing the challenges	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms, promotion of the technology/ product in the suitable areas conducting demos and field days and involvement of the stakeholder e.g. agro-chemical companies and agro-dealers. • Develop and disseminate information to various stakeholders. • Training on integrated approaches using available methods, including appropriate herbicides for sweetpotato. • Their persistence in different soil environment that can affect follow up crops in the rotation as a result of residues or carryover. • Safe use of herbicides.
Lesson learnt in upscaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • That integrated approaches of weed management are more effective and environmentally friendly than use of one control method. • A number of vegetables are produced under plastic mulch in rotation with sweetpotato which may affect herbicide behavior reducing volatility and condensation phenomena and crop selectivity could be modified. • Continuous use of herbicide is an environmental, health and social hazard. • Rotations with vegetables are very fast and intensive in many places and herbicide toxicity can affect next crop if the cycle of previous crops is short enough. • Consumer concerns of herbicide residues in the soil and subsequent crops needs attention • Creation of awareness through demonstrations and farmer field days help in adoption of IWM technology • Availability of market is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Train on understanding the working of Integrated Weed Management (IPM). • Have an environmental and safety plan when using herbicides. • Address the environmental and social concerns related to use of agrochemicals. • A functional agrodealer network to supply the products when required by the farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000-400,000/ acre
Gender issues and concerns in development and	Since weeding in sweetpotato is mostly done by women and children, dissemination strategies should target them more but also take men by

dissemination	sensitizing men so that they become aware of the TIMP.
Gender issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> • Make all gender understand the benefits of IWM. • Empower both men and women to make a judicious decision on IWM approach. • Use of IWM technology can reduce toil from manual weeding and save time for other activities to women
Gender related opportunities	Labour is reduced therefore opportunities exist for women and youth to get in other economic activities including the production and marketing.
Vulnerable and marginalized groups (VMG) issues and concerns in development, dissemination, adoption and scaling up	VMG groups could be having limitations in accessing the knowledge, resources and exposed to many threats such as insecurity and land disputes.
Vulnerable and marginalized groups (VMG) related opportunities	Training VMG on IWM practices and opportunities
E: Case studies/profiles of success stories	
Success stories	Kenya small holder farmers.
Application guidelines for users	<p>Referenes</p> <ul style="list-style-type: none"> • Momanyi VN, Amata R Wakoli E. Evaluation of Weed Management Options to Enhance Sweetpotato Production in Kenya. International Journal of Innovative Science, Engineering and Technology (IJSET). 2016;3(2):286-289. • All Answers Ltd. Weed Control, Sustainability, Hazards and Risks in sweetpotato Cropping Systems. Reviewed 2018. Retrieved from https://ukdiss.com/examples/sweetpotato-cropping-systems-weed-control.php?vref=1
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Requires validation.
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel:+254-0721822312, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO , Kabete, Dr Hottensiah Mwangi, Dr Momanyi Violet, John N. Ndung'u
Partner organizations	KALRO, NGOs, CBOs, County Governments, KEPHIS

2.7.27. Sweetpotato Intercropping System

TIMP Name	1.1.2 Sweetpotato Intercropping System
Categories (i.e. technology innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Weed competition is a problem in sweetpotato cropping system. Most farmers prefer inter-cropping sweetpotato with other crops including maize, legumes and vegetables to reduce weeding and have better returns for their investment. Intercropping to control weeds requires specific spacing, the right spacing depending on growth habit of the intercrop. This requires understanding of the optimal crop spacing and configuration, selection of varieties adapted to sweetpotato

	<p>intercropping and adopting sequencing approaches that will maximize use of the resources (water, nutrients and light) without causing undue competition and farmers lack this knowledge.</p>  <p><i>Nicandra physalodes</i>. A common weed of sweetpotato Source: Violet Momanyi</p>
<p>What is it? (TIMP description)</p>	<p>Innovative sweetpotato intercropping system is the growing of two or more crops in a field at the same time, as a tool to enhance agricultural production and to obtain efficient land use by reducing weed area. Intercropping systems are defined based on the temporal and spatial arrangements of the crops. There are several intercropping systems such as mixed, strip, row intercropping patterns, Relay and Alley intercropping. Farmer’s common intercropping system involves planting vegetables, legumes or maize in between rows of sweetpotato or at the edge of plots. Innovative intercropping systems will involve arrangement that reduces weeds. More complex intercropping systems with more than 2 crops have also been tested.</p>
<p>Justification</p>	<p>Intercrops and straw in middle rows can provide weed control between rows and reduce weed establishment in the field. Innovative intercropping systems can help farmers achieve the desired yield gains while at the same time diversifying the cropping system and adapting to climate change. Poor intercropping results in low yields attributed to competition for growth resources, light and nutrients and may lead to increased infestation of pests and diseases. Sweetpotato does well when intercropped with legumes and maize to mitigate the risk of total crop failure due to drought. Agricultural practices like intercropping are pro ecological; supporting bio-diversity and is compatible with the principles of balanced agriculture.</p>




Sweetpotato-maize intercrop
 Source: Farmbiz Africa



Sweetpotato-tomato intercrop in Kenya
 Source: Violet Momanyi

Intercropping has advantages in regard to efficient land use. It can significantly increase total productivity as compared to monocropping thanks to better utilization of water, nutrients and solar energy. Crops in these systems use available resources more efficiently due to different rooting and canopy properties. Intercropping systems is a climate adaptation strategy in case of crop failure in monocropping and is therefore considered as one of the most dependable ways to sustain crop production. It is a risk mitigation strategy by farmers in light of prevailing climate change.

B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers, Extension Staff
Approaches used in dissemination	Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Training workshops, Seminars, Meetings Promotional materials (posters/ brochures/ leaflets/ manuals)

	 <p>Demos and field days Source: Hottensiah Mwangi</p>
Critical/essential factors for successful promotion	<p>Applied and adaptive Research to test, validate and release intercropping system in sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders Conduct demos and field days with farmer groups and stakeholders</p>
Partners/ stakeholders for scaling up and their respective roles.	<p>MoALFC, County extension staffs, NGOs, Private sectors e.g. agrodealers, research organizations (KALRO, Egerton University, UoN)</p>
C: Current situation and future scaling up	
Counties where already promoted if any	<ul style="list-style-type: none"> • Can grow at altitudes ranging from sea level to 2,500 m. • Requires moderate warm climate, temperatures between 21-26°C) with soil pH of 5.5-6.5. • Rainfall 500-1350mm annually • Heavy rainfall, high temperature and excess cloudiness encourage vegetative growth
Counties where TIMPs will be up scaled	<p>Bungoma, Kakamega, Busia, Vihiga, Siaya, Homabay, Kisumu, Kisii, Nyamira, Migori, Kericho, Nakuru, Turkana, West Pokot, Marakwet</p>
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the agronomic practices • Inadequate training and limited extension staff
Suggestion for addressing the challenges	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms • Facilitation of training of county extension staffs • Contact demos and field days
Lesson learnt in upscaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Intercropping systems are knowledge intensive and require making adjustments in traditional ways of cropping. Such a change calls for intensive training and demonstration for farmers to familiarize with the innovation and its benefits. • There is need to adapt the intercropping innovations in all environments/ AEZ • Creation of awareness through demonstrations and farmer field days help in adoption of the technology/ sweetpotato intercropping • Availability of market is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions	<p>A farmer learning platform is essential for training on how to deploy the innovative intercropping systems.</p>

necessary for development and upscaling	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000 – 400,000/ acre
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Complexity of the intercropping system can result in decreased labour, which could impact on the women who are key players during planting and weeding. • Need to train, especially women, on how to implement the intercropping systems.
Gender related opportunities	Diversity and yield stability are a major win for the entire household.
VMG issues and concerns in development, dissemination, adoption and scaling up	This is a knowledge intensive innovation especially the configurations. Training is key. Intercropping systems may hamper mechanization of the production system.
VMG related opportunities	<ul style="list-style-type: none"> • System diversification and yield stability will increase food availability leading to food and nutrition security at household level. • Improved income from production and marketing of intercrops in systems gives diversified incomes.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<ul style="list-style-type: none"> • Plant the preferred crop between sweetpotato rows Supplement nutrients to minimize competition between the two crops.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	2. Require validation
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI Tel:+254-0721822312, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO Kabete, Dr Hottensiah Mwangi, Dr Violet Momanyi.
Partner organizations	MoALFC, County Extension Staff, Farmer Groups and CBOs, NGOs

2.7.28. Cover cropping for sweetpotato weed management



TIMP Name	Cover cropping for sweetpotato weed management
Categories (i.e. technology innovation Or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addresses	<p>Problem addresses</p>  <p><i>Common weeds of sweetpotato</i></p>
What is it? (TIMP description)	Innovative Cover cropping is growing of specific selected crops to

	produce biomass/ canopy to cover soil. This may be live cover or dead crop residue. After cover crop has produced biomass, it may later be killed by rolling it down or desiccated with a herbicide to form a soil cover. This cover acts as a physical barrier cutting off light to stop germinating weed seeds and stop emerging weeds. Large amounts of cover crop biomass suppress weeds in a subsequent season and duration depends on type of cover crop used and amounts of biomass.
Justification	Cover cropping with appropriate cover crop technology works well with sweetpotato in no till system. A cover crop is planted to develop cover. Large amounts of biomass developed by cover crops suppress weeds for a month or two depending on amount of biomass. Cover crops may also be left to conserve moisture and modify soil temperatures where necessary as an added benefit. Good cover crops include legumes.
B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers, Extension Staff
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties • Availability of market • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Demos and field days
Critical/ essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release cover cropping technology in sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Conduct demos and field days with farmer groups and stakeholders
Partners/ stakeholders for scaling up and their respective roles.	MoALFC, County extension staffs, NGOs, research organizations (KALRO, Egerton University, UoN)
C: Current situation and future scaling up	
Counties where already promoted if any	Bungoma, Kakamega, Busia, Vihiga, Siaya, Homabay,
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the agronomic practice • Labour intensity in planting and weeding • Inadequate training and limited extension staff
Suggestion for addressing the challenges	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms • Information dissemination on the technology • Promotion of the technology in the suitable areas • Facilitation of training of county extension staffs • Contact demos and field days
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the technology of intercropping

	<ul style="list-style-type: none"> • Availability of market is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Cover cropping technology is knowledge intensive and require making adjustments in traditional ways of cropping. Such a change calls for intensive training and demonstration for farmers to familiarize with the technology and its benefits. • There is need to adapt the technology when promoting in new environments/ AEZ
Social, environmental, policy and market conditions necessary for development and upscaling	A farmer learning platform is essential for training on how to deploy the technology.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000 – 400,000/ acre
Gender issues and concerns in development, dissemination adoption and scaling up	Cover cropping system can result in reduced labour, which could impact on the women who are key players during planting and weeding. Need to train, especially women, on how to implement the cover cropping systems.
Gender related opportunities	Diversity and yield stability are a major win for the entire household.
Vulnerable and Marginalized Groups (VMG) issues and concerns in development, dissemination, adoption and scaling up	This is a knowledge intensive technology especially the configurations. Training is key. Cover cropped systems may require specialized implements for direct planting.
VMG related opportunities	System diversification and yield stability will increase food availability leading to food and nutrition security at household level. Improved income from production and marketing of sweetpotato and other cover crops gives diversified incomes.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<p>Referenes</p> <ul style="list-style-type: none"> • Mwangi, H.W., Kihurani, A.W., Wesonga, J.M., Ariga, E.S. & Kanampiu, F. (2015a). Factors influencing adoption of cover crops for weed management in Machakos and Makueni counties of Kenya. <i>European Journal of Agronomy</i> 69(2015)1-9. Http://dx.doi.org/10.1016/j.eja.2015.05.001. • Mwangi HW, Ngahu J, Kihurani A. Effect of legume cover crops and imazapyr herbicide coated seed on weeds and green maize yield. Proceedings: 2ACAAC – Second Africa Congress on Conservation Agriculture held on 9-12 October 2018 Johannesburg, South Africa. 1116-0301 Published by Elsevier B.V. • Extension and training material available
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	2. Require validation
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI Tel:+254-0721822312, E-mail: cd.narl@kalro.org

Lead organization/scientists	KALRO Kabete, Dr Hottensiah Mwangi, Dr Violet Momanyi, John N. Ndung'u.
Partner organizations	County Extension Staff, Farmer Groups and CBOs, NGOs

2.7.29. Mulching sweetpotato

TIMP name	Mulching for sweetpotato weed management
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Weed competition for soil moisture and nutrients; and Regulation of soil temperatures where necessary.
	
	Weed suppression in mulched compared with weed infestation in unmulched sweetpotato fields. Source: Violet Momanyi
	 <p>Weed free mature sweetpotato in a mulched field Source: Violet Momanyi</p>
What is it? (TIMP description)	<p>The practice of covering the soil/ ground with natural materials or synthetic materials. Mulches can effectively control weeds from seeds that germinate near or at the soil surface. Types of mulches comprise of biodegradable or natural mulches. Biodegradable (include straw, dead leaves and compost) make more favourable conditions for plant growth, development and efficient crop production. The mulches should be between 2-4 inches deep to be effective.</p> <p>Benefits: Organic mulches suppress weeds; retain moisture in the soil; keep the soil cool; and help improve soil fertility (as the mulches decompose) and improves microclimate hence favour biodiversity.</p> <p>Synthetic mulches such as black polythene paper will solarize soils, control weeds and weed seeds, retain soil moisture and control diseases. Inspect and pull out emerging weeds timely.</p>



Mulching sweetpotato immediately after planting vines
Source: Violet Momanyi



Continuous replacement of mulch
Source: Violet Momanyi

Justification

Black polythene prevents light from reaching the small weeds and prevents germination. Organic mulching (straws or dry leaves) on rows add benefits other than minimizing weed infestation, facilitates retention of soil moisture and helps to control temperature fluctuations, improves physical, chemical and biological properties of soil, as it adds nutrients to the soil. This enhances the growth and yield of crops. It also improves soil structure directly by preventing raindrop impact and indirectly by promoting biological activity. Synthetic mulch is easy to obtain and apply, and is reusable. Sweetpotatoes should be mulched soon after planting. Straw or old leaves can be used in warm areas where black plastic isn't required. This will help keep the soil moist and block out weeds. Until they're large it's a good idea to keep them well mulched or weeded occasionally to keep weeds from overtaking them.




Black plastic film laid down in strips ready for planting sweetpotatoes
Source: garden-gardget.com

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Farmer field Business schools • On-farm demonstrations during farmer field days • Training in workshops
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release mulching technology in sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Organic: Availability of plant or crop residues for organic mulches. • Size of the land. • Competing uses of crop residues. • Type of the crop residues • Synthetic material for mulching • Cost of materials • Disposal of material after use.
Partners/stakeholders for scaling up and their roles	<p>MoALFC, County government extension services; to provide link with farmers</p> <p>Community farmer groups; play coordination role for ease in problem identification and dissemination</p>
C: Current situation and future scaling up	
Counties where already promoted	Siaya
Counties where TIMP will be promoted	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the agronomic practice • Labour intensity and availability of mulching materials • Lack of enough plant and crop residues due to competing uses of organic mulches. • Possibilities of insect build up categorized as pest or disease vectors or weed seeds in organic mulches. • Beware of small tears and rips which will allow weed emergence through plastic mulches including around the holes. Purple and yellow nutsedge may penetrate mulches as early as six days after transplant in plastic mulches.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms • Crop diversification to increase availability of organic mulches. • Establish and follow a good integrated weed management control program for the particular melon varieties. • Monitor for any tears /rips and pull out any weeds without allowing them to take over. • Adapting alternative mulching materials like high absorbance polymers.
Lessons learnt	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties

	<ul style="list-style-type: none"> • Creation of awareness through demonstrations and farmer field days help in adoption of IWM technology • Availability of market is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • There is need to adapt to alternative mulching technologies in addition to use of organic materials like straws dry leaves, and dry grass.
Social, environmental, policy and market conditions necessary	Practice is socially acceptable Environmentally friendly Increased productivity will provide supply to the markets Supporting frameworks/policies are available.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000 – 400,000/ acre
Gender issues and concerns in development, dissemination, adoption and scaling up	The practice uses remnants from previous crops/ plants that may offer competition in terms of fuel wood and livestock thus bringing a conflict with those performing the specific tasks, e.g. women in case of fuel wood and men for livestock feed. This will negatively affect the adoption and scaling up.
Gender related opportunities	Women who mainly perform weeding tasks will get a relief and spend their efforts elsewhere. Similarly, the improved productivity will benefit both gender in terms of higher earnings.
Vulnerable and Marginalized Groups (VMG) issues and concerns in development, dissemination, adoption and scaling up	Though easy to use, it is labour intensive for VMGs, hence its adoption and scaling up is a challenge.
VMG related opportunities	Mulch is locally available on-farm, and thus has very low costs implying that all including VMGs can take advantage of the practice.
E: Case studies/profiles of success stories	
Success stories	Farmers in different value chains have reported improved soil conditions, reduced runoff and nutrient loss, soil moisture retention in the soil and generally increased crop production following application of mulching technology.
Application guidelines for users	User guidelines are dependent on value chain. <ul style="list-style-type: none"> • Plant clean sweetpotato planting material in clean seed beds • Apply mulch between the rows of sweetpotato rows. Mulch management Hand pull or kill weeds that grow out of the mulch.
F: Status of TIMP readiness (1=Ready for upscaling; 2=Requires validation; 3=Requires further research)	Ready to use.
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI Tel:+254-0721822312, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, Dr Hottensiah Mwangi, Dr Violet Momanyi.
Partner organizations	County governments, Public-Private-Partnerships

2.7.30. Herbicide (Chemical) Weed Control

TIMP Name	Herbicide (Chemical) Weed Control in sweetpotato
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Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	<p>Competition from weeds prevents sweetpotato from getting nutrients, soil moisture and space resulting to weak and stunted growth leading to reduced final yields. This poses a problem to young sweetpotato. Amount of damage on young sweetpotato depends on weed density and diversity, stage and growth of weeds and environment. The grass weeds include crab sanguinalis (<i>Digitaria sanguinalis</i>) and goose grass (<i>Eleusine indica</i>). Because of limited chemical options, control of broadleaved weeds including Palmer amaranths (<i>Amaranthus palmer</i>), Red pigweed (<i>Amaranthus retroflexus</i>), Purple nutsedge (<i>Cyperus rotundus</i>) and Yellow nutsedge (<i>Cyperus Esculentus</i>) are more challenging. The weed problem is intensified by wrong timing and poor method of weed control.</p>
What is it? (TIMP description)	<p>Chemical weed control refers to any technique that involves the application of herbicide to weeds or soil to control the germination and growth of the weed species. Herbicide weed control is a technology that requires intensive knowledge on herbicides mode of action, the selective ones for sweetpotato, conditions necessary for application to be effective, type of soil, when to apply and how application is done.</p> <p>Use only recommended herbicides listed by Pesticide Control and product Board (PCPB). Pre-planting herbicides such as Lasso® combined with Farmuron® applied on the soil of a clean seed bed one to two weeks before planting sweetpotato vines prevents weed seeds from germinating.</p>  <p><i>Clean weed free sweetpotato field 3 weeks after planting. Was sprayed with pre-planting herbicides Lasso® combined with Farmuron®.</i> <i>Source: Violet Momanyi</i></p>
Justification	



Laborious hand weeding of fields.

Source: Hottensiah Mwangi

Manual land preparation and hand weeding is very labour intensive yet labour is scarce and expensive.



Hand Herbicide application

Source: Hottensiah Mwangi

Appropriate use of herbicides (apply using the right rate stated on the label) reduces drudgery and allows timely weed control. Several selective herbicides are registered for control of annual and perennial weeds in sweetpotato. Other post emergence herbicides are applied in middle rows using a hood to avoid crop injury. Proper calibration of sprayer is critical to maintain correct sprayer pressure, flow rate from each nozzle and walking speed.


Counties promoted	Siaya and Kiambu
Counties where TIMP will be upscaled	Bungoma, Kakamega, Busia, Vihiga, Siaya, Homabay, Kisumu, Kisii, Nyamira, Migori, Kericho, Nakuru, Turkana, West Pokot, Marakwet
B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers and extension agencies
Approaches used in dissemination	<ul style="list-style-type: none"> Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, larger plot demonstrations, training on safe use of herbicides.
Most effective approach	On-farm experimentation and larger plot effect demonstrations.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Applied and adaptive Research to test, validate and release herbicide weed control in sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders Capacity building and training on safe use of herbicide for all users

Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Public and private partners such as MoALFC for extension, • Chemical companies and agrodealers. • FIPs (Farmer Input Promotion) for promotion. • Farmer Groups for activity implementation and promotion. • Service provider agencies e.g. Micro-finance agencies and banks for credit provision, agro-vets for input supply. • Processors and manufacturers to create market for produce, and others e.g. NGOs, CBOs, and FBOs to provide special services like community mobilization, nutrition training, value addition etc.
C: Current situation and future scaling up	
Counties where already promoted	Bungoma, Kakamega, Busia, Vihiga, Siaya, Homabay, Kisumu, Kisii
Counties where TIMP will be promoted	Migori
Current extent of reach	Validation of these herbicides needs to be done under different agroecological zones and soils before recommendations are given to the farmers.
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of agronomic practice • Limited knowledge and information and low literacy levels among the farmers or sprayers to read and interpret label instructions. • Capacity building is required to impart knowledge and skills in safe use and application of herbicides. • The farmers need to understand the proper use and application of herbicides to avoid buying inappropriate herbicides and thus minimize health, environmental and social hazards.
Recommendations for addressing the challenges	Establish sweetpotato innovation platforms, There is need to train the agricultural extension county officers as ToTs on appropriate use of herbicides so that the information reaches the farmers. Herbicides like all chemicals have to be used with care to avoid environmental, health and social hazards. Liaise with the Agricultural extension and environmental officers on the ground for farmer empowerment and guidance on safe use of herbicides.
Lessons learnt	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the chemical weed control technology • Consumers concerns of herbicide residues in the soil and subsequent crops needs attention • Availability of market is essential • Partnership is important in technology dissemination and adoption which can be facilitated through innovation platforms • Access to and use of information on different methods of weed control will reduce drudgery and cost of weed management. It could give room to increased area under cultivation and increase in productivity.
Social, environmental, policy and market conditions necessary	Sensitization of communities on alternative methods of weed control and appropriate use of herbicides is vital.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000 – 400,000/ acre
Gender issues and concerns in development and dissemination	
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	Women and children are the main sources of labour in sweetpotato production. Adoption of technology will reduce the labour burden on women and children. The children can get time for school work, while the women can engage in other economic activities.
Gender related opportunities	Women stand to benefit in increased production due to timely operations, increased yields and sales.
Vulnerable and Marginalized Group (VMG) issues and concerns in development and dissemination	Due to prejudice associated with their social status, VMGs are excluded from accessing benefits from improved technologies. Thus, affirmative action is required to promote the sweetpotato for the VMGs including value addition aspects.
VMG issues and concerns in adoption and scaling up	Timely operations will lead to enhanced production by VMGs.
VMG related opportunities	Use of herbicides will improve weed management leading to increased productivity, increase availability of sweetpotato for consumption which will improve food security hence improved health of VMGs; high value of crop will lead to economic empowerment of VMGs.
E: Case studies/profiles of success stories	
Success stories	Not yet adopted by smallholders
Application guidelines for users	<ul style="list-style-type: none"> • Rational use of herbicides. Eco friendly Weed Control options for Sustainable Agriculture. Science Alert. Review article. Scialert.net/fulltext/ • Follow instructions on the pesticide label • Weed control leaflets/ manuals. Information and instructions always displayed on the labels attached to container on how to use.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires Research)	
	Requires validation and more research
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI Tel:+254-0721822312, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO Dr Hottensiah Mwangi, Dr Violet Momanyi.
Partner organizations	MoALFC in Counties, Chemical companies.

2.7.31. Solarization Bed

TIMP Name	Solarization Bed for Weed Control in sweetpotato
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Competition from weeds in causes weak and stunted growth in all sweetpotato varieties. Weeds pose a problem in young sweetpotato seedling during the critical period of weed management. This depends on weed density, diversity, stage of weed growth and environment. Grass weeds include crab sanguinalis (<i>Digitria sanguinalis</i>), Sudan grass (<i>Sorghum halepense</i>) and goose grass (<i>Eleusine indica</i>) and <i>Echinochloa</i>


	<p><i>colona</i>. Broadleaved weeds include Palmer amaranths (<i>Amaranthus palmeri</i>), Red pigweed (<i>Amaranthus retroflexus</i>), (<i>Chenopodium album</i> L.), (<i>Rumex crispus</i> L.) and <i>Portulaca oleraceae</i>. The Purple nutsedge (<i>Cyperus rotundus</i>) and Yellow nutsedge (<i>Cyperus Esculentus</i>) are more challenging. The weed problem is worsened by herbicide resistance, weed shift, threats to environment and wrong timing and use of poor methods of weed management practices.</p>  <p><i>Diversity of weed species (grasses, broadleaved, annuals and perennials) that emerge to compete with young sweetpotato seedling for available nutrients, moisture and space</i> <i>Source: Violet Momanyi.</i></p>
<p>What is it? (TIMP description)</p>	<p>Solarization is a method where you use transparent polythene films that increase soil temperatures by 10⁰C or more than atmospheric to kill weed seeds and seedlings. Basic phenomena is building up of lethally high temperatures in top soil where most dormant and viable seeds are present. The Mechanism is mainly breaking dormancy of weed seeds and solar scotching of emerged weed seedlings that directly kill weed seeds by heat. The mechanism can increase soil temperature by 8-12 °C over non mulched soil. Rhizomes of perennial weeds may be killed if not deeply buried. Effectiveness is species specific and also depends on the length of the heating period.</p>
<p>Justification</p>	<p>Solarization for two or three consecutive years is successful in controlling perennial weeds such as sedges in sweetpotato. Solarization with 0.05mm T Polythene sheets 40 days is effective in controlling weeds than use of 0.01mm polythene that takes shorter time duration. This is a good ecological and environmentally friendly method that is sustainable for small scale organic growers.</p>
<p>Region promoted</p>	<p>California</p>
<p>Counties where TIMP will be upscaled</p>	<p>Bungoma, Kakamega, Busia, Vihiga, Siaya, Homabay, Kisumu, Kisii, Nyamira, Migori, Kericho, Nakuru, Turkana, West Pokot, Marakwet</p>
<p>B: Assessment of dissemination and scaling up/ out approaches</p>	
<p>Users of TIMP</p>	<p>Farmers and extension agencies</p>
<p>Approaches used in dissemination</p>	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, larger plot demonstrations, training on how to use solarization in sweetpotato farming.
<p>Most effective approach</p>	<p>On-farm experimentation and larger plot effect demonstrations.</p>

Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release solarization bed technology for weed control in sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Development of the agronomic practice for sweetpotato farming • Capacity building and training on use of polythene and solar power.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Public and private partners, MoALFC for extension, • Chemical companies for back stopping. • FIPs (Farmer Input Promotion) for promotion. • Farmer Groups for activity implementation and promotion. • Service provider agencies e.g. Micro-finance agencies and banks for credit provision. • Processors and manufacturers to create market for produce, aggregators e.g. CARD (Community Action for Rural Development) for economy of scale sales and marketing), and others e.g. NGOs, CBOs, and FBOs to provide specialist services like community mobilization, nutrition training, value addition experts etc.
C: Current situation and future scaling up	
Counties where already promoted	Kericho, Nakuru, Turkana, West Pokot
Counties where TIMP will be promoted	Migori
Current extent of reach	Validation of solarization technology in sweetpotato needs to be done before recommending to the farmers.
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the agronomic practice • Labour intensity • Limited knowledge, information and low literacy levels among sweetpotato farmers. • Capacity building is required to impart knowledge and skills in appropriate use and application of solarization. • The farmers need to understand the proper use and application of solarization to avoid buying inappropriate polythene and minimize health, environmental and social hazards.
Recommendations for addressing the challenges	Establish sweetpotato innovation platforms, There is need to train the agricultural extension county officers as ToTs on appropriate use of solarization. This will help in reaching the farmers with the information. Polythene disposal should be done carefully to avoid environmental, health and social hazards. Liaise with the Agricultural extension and environmental officers on the ground for farmer empowerment and guidance on polythene reuse and disposal.
Lessons learnt	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform. • Creation of awareness through demonstrations and farmer field days help in adoption of the technology of Solarization bed for weed control • Availability of market is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms. • Access to and use of information on different methods of weed control will reduce manual labor and cost of weed management. It could give

	room to increased area under cultivation and thus increased productivity.
Social, environmental, policy and market conditions necessary	Sensitization of communities on alternative methods of weed control and appropriate use of polythene is very necessary.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000 – 400,000/ acre
Gender issues and concerns in development and dissemination	
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	Women and children are the main sources of labour in sweetpotato production. Adoption of the technology will reduce the labour burden on women and children. The children can get time for school work, while the women can engage in other economic activities.
Gender related opportunities	Women will benefit in increased production due to timely operations, increased yields and sales.
Vulnerable and Marginalized Groups (VMG) issues and concerns in development and dissemination	Due to prejudice associated with their social status, VMGs are excluded from accessing benefits from improved technologies. Thus, affirmative action is required to promote solarization technology for the VMGs including value addition aspects.
VMG issues and concerns in adoption and scaling up	Timely operations will lead to enhanced production by VMGs.
VMG related opportunities	Increased production will lead to increased consumption of sweetpotato varieties high in Vitamins and antioxidants hence improved health of VMGs. High value returns of the crop will lead to economic empowerment of VMGs.
E: Case studies/profiles of success stories	
Success stories	Pakistan
Application guidelines for users	<p>Referenes</p> <ul style="list-style-type: none"> • Muhammad A.K. et al.,(2012). An approach to organic weed management. <i>J. Communications soil science and plant analysis</i>.43:1847-60. DOI:10.1080/DOI03624 • Ali El Keblawy and Hamadi F.A (2009). Assessment of the differential response of weeds to soil solarization by two methods (2009). Research gate.net publications-230177258. <i>J. Weed biology and Management</i>. Weed control leaflets/ manuals. Information and instructions always displayed on the labels attached to container on how to use.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires Research)	
	Requires validation and more research
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI Tel:+254-0721822312, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, Dr Hottensiah Mwangi, Dr Violet Momanyi, John N. Ndung'u
Partner organizations	MoALFC in Counties, Chemical companies.

2.7.32. Stale seed bed for Weed Control

TIMP Name	Stale seed bed for Weed Control in sweetpotato
Category (i.e. technology, innovation or management)	Technology




practice)	
A: Description of the technology, innovation or management practice	
Problem addressed	<p>Competition from weeds prevents sweetpotato from getting available resources which interfere with growth especially for young sweetpotato. Competition depends on weed density, diversity, stage of weed growth and environment. Problematic weeds include crab sanguinalis (<i>Digitaria sanguinalis</i>), couch grass (<i>Digitaria abyssinica</i>) and goose grass (<i>Eleusine indica</i>). Broadleaved weeds include Red pigweed (<i>Amaranthus retroflexus</i>), black jack (<i>Bidens pilosa</i>) and Datura (<i>Datura stramonium</i>). Wrong timing and poor weed control activities hasten weed infestation.</p>  <p><i>Datura stramonium</i> weed. A common weed in sweetpotato Source: Violet Momanyi</p>
What is it? (TIMP description)	<p>Stale seed bed “false” is where seeds are allowed to germinate by rainfall or wetting and killing them (1-2 flushes of the weeds) before planting sweetpotato vines. Weeds are killed using herbicides such as glyphosate, sulfosate and glufosinate. Shallow or use of non-residue paraquat may be used to destroy dense flush young weed seedlings followed by planting sweetpotato vines. Most weed seeds have the potential to develop where there is adequate soil moisture and temperature of 50⁰F at a depth of 2 inches. Several passes can be made in soil using roto Spike tooth hallow implement for destroying emerging weeds during preparation of stale beds. When weed seeds germinate they are desiccated or ploughed.</p>
Justification	<p>With sound knowledge of weed phenology and factors like temperature, irrigation and humidity at the local level it is possible to predict when certain weeds will raise problems in sweetpotato seedbed.</p>
Region promoted	<p>Applied in rice grown by irrigation</p>
Counties where TIMP will be upscaled	<p>Stale bed weed control can be upscaled in all the areas where sweetpotato is being grown.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<p>Farmers and extension agencies</p>
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Training workshops, Seminars, Meetings • On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, larger plot demonstrations, training on how to use stale bed.


Most effective approach	On-farm experimentation and larger plot effect demonstrations.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release stale seed bed for weed control in sweetpotato varieties • A platform for interaction of sweetpotato value chain stakeholders • Capacity building and training on use of stale bed
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Public and private partners MoALFC for extension, • Chemical companies for back stopping. • FIPs (Farmer Input Promotion) for promotion. • Farmer Groups for activity implementation and promotion. • Service provider agencies e.g. Micro-finance agencies and banks for credit provision, agro-vets for input supply. • Processors and manufacturers to create market for produce, aggregators e.g. CARD (Community Action for Rural Development) for economy of scale sales and marketing], and Others e.g. NGOs, CBOs, and FBOs to provide specialist services like community mobilization, nutrition training etc.
C: Current situation and future scaling up	
Counties where already promoted	Kericho, Nakuru, Turkana, West Pokot
Counties where TIMP will be promoted	Migori
Current extent of reach	Validation of these stale beds needs to be done before recommending to the farmers.
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the technology • Labour intensity • Limited knowledge and information and low literacy levels among the farmers. • Capacity building is required to impart knowledge and skills in safe use and application of stale beds. • The farmers need to understand the proper use stale beds and herbicides
Recommendations for addressing the challenges	Establish sweetpotato innovation platforms, There is need to train the agricultural extension county officers as ToTs on appropriate use of stale beds. This will help in reaching farmers with the information.
Lessons learnt	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the technology- Stale seed bed • Availability of market is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Consumers concerns of herbicide residues in the soil and subsequent crops needs attention • Access to and use of information on different methods of weed control will reduce labor and cost of weed management. It could increase area under cultivation and increase productivity.
Social, environmental, policy and market conditions necessary	Sensitization of communities on alternative methods of weed control and appropriate use of stale beds is very necessary.

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000 – 400,000/ acre
Gender issues and concerns in development and dissemination	
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	Women and children are the main sources of labour for sweetpotato crop. Adoption of technology will reduce labour for children who can get time for school work, and women to engage in other economic activities.
Gender related opportunities	Women will benefit from increased production since timely operations would increase yields and sales.
Vulnerable and Marginalized Group (VMG) issues and concerns in development and dissemination	Due to prejudice associated with their social status, VMGs are excluded from accessing to benefits from improved technologies. Affirmative action is thus required to promote the sweetpotato production for the VMGs including value addition aspects.
VMG issues and concerns in adoption and scaling up	Timely operations will lead to enhanced production by VMGs.
VMG related opportunities	Increased production will lead to increased consumption of sweetpotato varieties high in vitamins and antioxidants which will improve the health of VMGs. High production and value of the crop will lead to economic empowerment of VMGs.
E: Case studies/profiles of success stories	
Success stories	.
Application guidelines for users	Weed control leaflets/ manuals. Information and instructions on pesticide labels indicating how to use.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires Research)	Requires validation and more research
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI Tel:+254-0721822312, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO Dr Hottensiah Mwangi, Dr Violet Momanyi, John N. Ndung'u
Partner organizations	MoALFC in Counties, Chemical companies, Agrodealers.

2.7.33. Mechanical weeding

TIMP Name	Mechanical Weed Control in sweetpotato
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Manual hand weeding is labour intensive, back breaking and tiresome. It is usually done late when weeds have competed and overwhelmed the sweetpotato crop


	 <p><i>Manual weeding using “jembes”</i> <i>Source: Violet Momanyi</i></p>	
<p>What is it? (TIMP description)</p>	<ul style="list-style-type: none"> • Use hand tools to prepare land well to get a weed free seedbed. Plant clean vines into a weed free field. Plant in rows to facilitate inter row weeding. • Timely weeding is most effective at 3-4 weeks after planting. Second weeding can done about 3 weeks later depending on infestation. • Delayed weeding may result in weed take over with consequent severe competition with the sweetpotato. Weed using appropriate tools to avoid shock-stress on young sensitive sweetpotato due to disturbance of soil and root damage. • The intra row weeds can be removed by hand pulling. 	
	 <p><i>Source: Violet Momanyi</i></p>	 <p><i>Source: Hottensia Mwangi</i></p>
	<p>Manual land preparation and making rows for planting sweetpotato</p>	
<p>Justification</p>	<p>Weeds when not controlled take over, win the competition and and cause sweetpotato yield losses. Deep tilling brings dormant weed seeds to the surface and increases chances for germination of some species deeply buried in the soil in the year before favourable conditions allow germination. Fine soil or tilth allow weed seed to grow rapidly and roots to spread easier than compact soils. The emerged weeds can then be destroyed by mechanical weeding.</p>	
<p>Region promoted</p>	<p>All areas where sweetpotato is grown.</p>	
<p>Counties where TIMP will be upscaled</p>	<p>Bungoma, Kakamega, Busia, Vihiga, Siaya, Homabay, Kisumu, Kisii, Nyamira, Migori, Kericho, Nakuru, Turkana, West Pokot, Marakwet</p>	
<p>B: Assessment of dissemination and scaling up/out approaches</p>		
<p>Users of TIMP</p>	<p>Farmers and Agricultural extension officers.</p>	
<p>Approaches used in dissemination</p>	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, larger plot demonstrations. 	
<p>Most effective approach</p>	<p>On-farm experimentation and larger plot effect demonstrations.</p>	
<p>Critical/essential factors</p>	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved 	

for successful promotion	<ul style="list-style-type: none"> mechanical weeding in sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders Participatory Implementation, stakeholder sensitization.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> Public and private partners such as MoALFC for extension, Processors and manufacturers to create market for produce, aggregators e.g. CARD (Community Action for Rural Development) for economy of scale sales and marketing, and others e.g. NGOs, CBOs, and FBOs to provide specialist services like community mobilization, nutrition training etc.
C: Current situation and future scaling up	
Counties where already promoted	All counties except Migori
Counties where TIMP will be promoted	Migori
Current extent of reach	Limited research done on gender responsive weeding implements.
Challenges in dissemination	<ul style="list-style-type: none"> Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders Labour intensity Low use of agronomic practices Labour intensity Appropriate implements are not readily available in the market such as subsoilers.  <p><i>Subsoiling using a subsoiler for minimum soil disturbance</i> Source: <i>Hottensia Mwangi</i></p>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Establish sweetpotato innovation platforms Work with Jua Kali industries for fabrication of appropriate implements.
Lessons learnt	<ul style="list-style-type: none"> Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform Creation of awareness through demonstrations and farmer field days help in adoption of the technologies Availability of market is essential Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms Appropriate weeding tools (technology) will provide timely weed control with reduced drudgery to enhance sweetpotato crop production.
Social, environmental, policy and market conditions necessary	Community sensitization on mechanical weed management practices for young plants sensitive to weed competition.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000-400,000/ acre
Gender issues and concerns in development and dissemination	Need to sensitize both men and women on value of weed losses caused by weeds and timely weed control
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	Women and children are the main sources of labour. Increased workload of weeding directly affect women and school going children.
Gender related opportunities	Women stand to benefit in increased production which will improve diets and sale of sweetpotato will improve household income and livelihood.
Vulnerable and Marginalized Group (VMG) issues and concerns in development and dissemination	Due to prejudice associated with their social status, VMGs are excluded from access to and benefits from improved technologies. Thus, affirmative action is required to promote the crop for the VMGs including value addition aspects.
VMG issues and concerns in adoption and scaling up	Timely operations will lead to enhanced production for VMGs.
VMG related opportunities	Increased production will improve food and nutrition security and economic empowerment of VMGs
E: Case studies/profiles of success stories	
Success stories	All areas growing sweetpotato.
Application guidelines for users	ToT Manuals to include weed management TIMPs.
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Validation 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI Tel:+254-0721822312, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, Dr Hottensiah Mwangi, Dr Violet Momanyi, John N. Ndung'u
Partner organizations	MoALFC in Counties

2.7.34. Crop Rotation in sweetpotato

TIMP Name	Crop Rotation in sweetpotato
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Diverse weed species and rich weed seed banks in sweetpotato cropping systems contribute to high weed losses due to weed competition with the crop.



	 <p><i>Weeds to be controlled in sweetpotatoes</i> <i>Source: Hottensia Mwangi</i></p>
<p>What is it? (TIMP description)</p>	<ul style="list-style-type: none"> • A good successive weed control strategy starting with a Farm Plan with a rotation schedule incorporated for optimal sweetpotato production. This is a planned sequence of crops growing in the same field every year. Land is divided into a number of distinct areas. Keep plants of same type together. eg Peas - sweetpotato – maize - carrot or onions. Sweetpotato is a heavy feeder and should follow legumes. Rotation adds diversity to the cropping system, increases sustainability, of the system and provides the foundation of long term weed management. • Plant sweetpotato vines in rows in a clean weed free seed bed. Rotation is critical in order to obtain good weed control in the crop but emphasis before making decision should be on environment, weeds present, time of year, crop rotation, irrigation methods and herbicide cost. Good rotation is achieved by combining cultural and chemical (herbicide) weed management strategies. Two options 1.) Form beds well before planting, Flush weeds should be killed with a post emergence herbicide or shallow weeding. 2.) Form beds just before planting and remove any emerged weeds or use pre-plant herbicides such as glyphosate, paraquat and diquat depending on weeds present, stage of weed growth and herbicide cost. You can start by applying appropriate herbicide targeting specific weeds on your land eg Glyphosate 0.3-1.0 L/ha. Use a hooded sprayer direct in the middle of sweetpotato rows to control emerged grasses and broadleaved weeds when still small to reduce weeding costs. • Effective weed management must be done before sweetpotato is planted. • Detailed weed information (annual broad leaved or grasses) recorded or maps kept over time will help improve management decision in sweetpotato crop rotation.
<p>Justification</p>	<p>Planting a wide variety of crops with varied characteristics reduces the likelihood that specific weed species will become adapted to the system and become problematic. The successive rotation systems for weed suppression is somehow based on the use of crop sequences that employ varying patterns of resources competition, allelopathy interference, soil disturbance and mechanical damage to provide an unstable and frequently inhospitable environment that provides the proliferation of a particular weed species. Correct timely crop rotation minimizes weed population in current sweetpotato crop and reduces weed seed banks so there is less future infestations. Different crops grown in rotation break the cycle of weeds. The diversity of weed management strategies used for different crops also increases weed diversity and reduces prevalence of problematic weeds that can build over time. Optimal timing for Cultural operations is most effective for weed management because too early weeding does not</p>

	achieve full benefits since there is time for further weeds to germinate before canopy closes. Planting dates are important. The most effective management must be made before the crop is planted and this is taken care of when planning the rotation. Perennial weeds should be controlled during non- crop periods.
B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers and Agricultural extension officers
Approaches used in dissemination	<ul style="list-style-type: none"> Farmer field and business Schools(FFBS) Agricultural Innovation Platforms (AIP) On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, larger plot demonstrations.
Most effective approach	On-farm experimentation and larger plot effect demonstrations.
Critical/essential factors for successful promotion	Applied and adaptive Research to test, validate and release rotation practice in sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders articipatory Implementation, sensitization of stakeholders.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> Public and private partners such as MoALFC for extension Jua Kali artisans Processors and manufacturers to create market for produce, aggregators e.g. CARD (Community Action for Rural Development) for economy of scale sales and marketing], and Others e.g. NGOs, CBOs, and FBOs to provide specialist services like community mobilization, nutrition training etc.
C: Current situation and future scaling up	
Counties where already promoted	Busia, Vihiga, Siaya, Homabay, Kisumu, Kisii
Counties where TIMP will be promoted	Migori
Current extent of reach	Limited research done on appropriate rotations for sweetpotato systems.
Challenges in dissemination	<ul style="list-style-type: none"> Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders Low use of the technology Small farms due to family subdivisions Labour intensity Rotation schedules for sweetpotato not readily available.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Establish sweetpotato innovation platforms Information dissemination on the practices Promotion of the technology in the suitable areas Work with farmers to validate known schedules from other researchers or countries in different sweetpotato growing regions.
Lessons learnt	<ul style="list-style-type: none"> Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform Creation of awareness through demonstrations and farmer field days help in adoption of the technology Availability of market is essential Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms Crop rotation will provide timely weed control which will enhance crop production.
Social, environmental,	Sensitization of communities on sweetpotato rotation practices in weed

policy and market conditions necessary	management
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000 – 400,000/ acre
Gender issues and concerns in development and dissemination	Need to sensitize both men and women on value of crop rotation as a technology for timely weed control and reduction of weed seed banks.
Gender issues and concerns in development, dissemination concerns in adoption and scaling up	Women and children are the main sources of labour. Reduced workload of weeding is likely to directly impact positively on women and school going children.
Gender related opportunities	Women stand to benefit in increased production as sweetpotato is a nutritious food crop which will boost health. Sale of extra produce would improve the household income and livelihoods. Also weeding labour will be reduced.
Vulnerable and Marginalized Group (VMG) issues and concerns in development and dissemination	Due to prejudice associated with their social status, VMGs are excluded from accessing benefits from improved technologies. Thus, affirmative action is required to promote the sweetpotato crop for the VMGs including value addition aspects.
VMG issues and concerns in adoption and scaling up	Timely operations will lead to enhanced production by VMGs.
VMG related opportunities	Increased production will improve food and nutrition security and economic empowerment of VMGs
E: Case studies/profiles of success stories	
Success stories	sweetpotato farmers in Migori County.
Application guidelines for users	Production manuals to include crop rotation weed management TIMP
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Ready for validation Validation 3. Requires further research)	
G: Contacts	
Contacts	Centre Director KALRO Kabete, P.O. Box 14733-00800, NAIROBI. Tel:+254-0721822312, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO, Dr Hottensiah Mwangi, Dr Violet Mumanyi, John N, Ndung'u
Partner organizations	ICRISAT Nairobi; MoALFC in Counties

2.7.35. Safe Use of herbicides

TIMP Name	Safe Use of herbicides
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Excessive herbicide application on crops and the soil, use of herbicides for spraying crops without wearing the right Personal Protective Equipment (PPE), storage of herbicides in non-designated stores, wrong application techniques, spraying at the wrong times and against the wind direction, and use without following guidelines specified on the labels (eg rate and Pre-Harvest Interval (PHI)), disposal of expired herbicides and

	empty containers, inadequate enforcement of global and national policies and regulation on use of pesticides.
What is it? (TIMP description)	Capacity building of farmers, crop protection teams on safe handling and use of herbicides right from transportation from the agro-dealers to storage in their houses, mixing procedures and their application in the field in order to ensure safety of the crop, the handler/ applicator and the environment at large. The technology will include proper methodologies for proper herbicide disposal to minimize pollution of the environment.
	 
	<p><i>Full protection when spraying</i> Source: Hottensiah Mwangi</p> <p>Partial protection is not allowed Source: Violet Momanyi</p>
Justification	Although cases of improper and misuse use of pesticides are very common in most of the areas where sweetpotato and other crops are grown, they are not well documented. There have been incidences of excessive use, improper handling that lead to exposure and poisoning of spray operators while spraying, use of inappropriate and leaking spray equipment equally expose the operators to health risks as well as contamination of the water bodies. Most of these irregularities can easily be corrected through sensitization and capacity building forums for end users to be made aware of the best practices that should be used when handling herbicides and other pesticides. Reports have shown increase of chronic diseases in human beings.
B: Assessment of dissemination and scaling up/ out approaches	
Users of TIMP	Farmers, sweetpotato producers
Approaches used in dissemination	<ul style="list-style-type: none"> Farmer field and business Schools(FFBS) Agricultural Innovation Platforms (AIP) Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, Plant clinics, Pesticides spray Demonstrations.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Applied and adaptive Research to test, validate and employ safe use of herbicide application in sweetpotato varieties A platform for interaction of sweetpotato value chain stakeholders Development of agronomic practices for sweetpotato Collaboration between all partners, willingness of farmers to adhere to proper guidelines. Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	MoALFC-Extension Service to conduct extension services and farmer trainings, Individual Farmers, farmer groups/ CBOs to participate in the implementation of the various technologies for sweetpotato production, KALRO and Universities to develop the technologies and conduct ToTs. AAK, PCPB, KEPHIS.



C: Current situation and future scaling up	
Counties where technology is already being promoted if any	Bungoma, Kakamega, Busia, Vihiga, Siaya, Homabay, Kisumu, Kisii, Nyamira
Counties where TIMP will be promoted	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of sweetpotato innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of technology • Labour intensity and requires skilled man power • Change of mindset in favour of current practices maybe difficult to achieve. • Illiteracy and inadequate capacity to use herbicides correctly. Most farmers cannot read and interpret the labels properly resulting in misuse, overuse or underuse of herbicides. • Use of banned pesticides from neighboring countries • Inadequate capacity by farmers and agrochemical companies to dispose herbicides (pesticides) properly
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish sweetpotato innovation platforms • Capacity building and sensitization forums for both farmers and agro dealers using participatory approach. • Formation of youth spray teams. • Establishment of aggregation centres for pesticide containers • Establishment of training of Extension staff and lead farmers as ToT. • Increase surveillance along the border points and enforce the laws.
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the technologies • Availability of market is essential • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Consumers concerns of herbicide residues in the soil and subsequent crops needs attention • Upscaling of this technology needs young men and youth as spray men due to its hazardous nature. Some of the aspects of this technology need a lot of capital to actualize. For instance, the collection and incineration of pesticide containers needs a lot of money that may not be accessible by most men or youth groups. The illiteracy levels of some farmers may hinder the use of correct information/ knowledge in the use of herbicides in some areas.
Social, environmental, policy and market conditions necessary	Organized collective marketing channels is critical for benefits to be derived from the practice/ technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About KES 120,000/ acre
Estimated returns	4-12 ton/ acre, KES 320,000 – 400,000/ acre
Gender issues and concerns in development, dissemination, adoption and scaling up	Technology is not safe for use by expectant women and physically challenged people because of its hazardous/ dangerous nature. Herbicides and protective gear are expensive and most farmers including women may not afford them.

	Lack of knowledge by men and women on the dangers of herbicides especially on storage and disposal. Low levels of illiteracy and inability to read and interpret instructions on the herbicide labels especially on re-entry period after spraying and PHI. This can cause herbicides poisoning due to exposure.
Gender related opportunities	<ul style="list-style-type: none"> • Formation of spray teams by young men • Formation of surveillance/ scouting groups by women
VMG issues and concerns in development, dissemination, adoption and scaling up	These are dangerous products that may not be handled by vulnerable groups. Herbicides are expensive for most youths and physically challenged groups that may not utilize them.
VMG related opportunities	Safe use of herbicides can easily be undertaken by the youth as an enterprise by forming Spray teams in the wards in each county. Youths to offer spray calibration services to farmers as an enterprise. Youths to help in the collection of pesticide containers and assist in the incineration processes organized by AAK. Youth to own and operate agrochemicals that stock right pesticides and offer advisory services to farmers at the agroveter shops
E: Case studies/profiles of success stories	
Success stories	The AAK has trained youth spraying teams that help in spraying of farms in a few counties thus reducing cases of people being exposed to herbicides. Some counties who have aggregation centres by AAK for collection of pesticide containers. This has led to reduction of these containers on farms. Safe use of Pesticide campaigns by AAK, PCPB, KALRO and MoALFC.
Application guidelines for users	Sensitization of farmers on harmful effects of pesticides on human beings and environment. Capacity-build farmers and youth on spraying techniques using developed curriculum by AAK and PCPB. Assist youth to form spraying teams and equip them with PPEs. Train Extension staff as Plant doctors using the Centre for Agriculture and Bioscience International (CABI) modules, manuals and establish Plant Clinics in the target counties. Develop and equip the Plant Doctors and youth spraying teams with pest decision guidelines, manuals, brochures developed by KALRO and CABI as reference material
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Ready for upscaling
F: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel:+254-0721822312, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO: Dr Hottensiah Mwangi, Dr Violet Momanyi, John N. Ndung'u
Partner organizations	MoALFC, CABI, PCPB, AAK, KEPHIS, County Governments, Universities

2.8 POSTHARVEST MANAGEMENT

2.8.1. Harvesting of sweetpotato

TIMP Name	Harvesting of sweetpotato
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	 <p>Harvested sweetpotatoes</p>  <p>Harvesting sweetpotatoes in Elgeyo Marakwet</p>
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Losses due to incorrect timing of harvest, determinants of harvest and inappropriate harvesting methods
What is it? (TIMP description)	<p>This is a management practice involving careful maturity indices, pre-harvest operations and harvesting process.</p> <p><u>Maturity indices for sweetpotato roots:</u> Sweetpotatoes are ready for harvest when:</p> <ul style="list-style-type: none"> • They are between 3 and 7 months after planting depending on the variety and environmental condition. • Leaves turn yellow and dry • Latex from a mature cut root remains white (latex is a sap that is stored in tissues that is excluded from a point of damage in plant tissues, e.g.) • Cut root wound dry quickly after exposure to air • The soil crack indicating maturity and location of the root. <p><u>Maturity indices for sweetpotato leaves,</u> Leaf harvesting for vegetable use starts two months after planting</p> <p><u>Pre-harvest operations</u></p> <ul style="list-style-type: none"> • Dehaulm the sweetpotatoes when the aerial part of the crop turns yellow (80-90 days after transplanting) • Stop irrigation two weeks before dehauling • Harvest after 10-15 days of haulm cutting • Sprinkle dry soils


	<ul style="list-style-type: none"> Eliminate vines before digging <p>Harvesting Roots: Harvesting of sweetpotato is done either manually or by machines (combine harvester). Manual harvesting is done by first finding the primary crown of the plant you need to dig and then using a digging fork or hand hoe or machete or spade loosen an 18-inch wide circle around the plant. Then lift the roots by hand in the ground. Shake off any excess dirt. The Sweetpotato are stacked in clean crates ready for transportation. Mechanical harvesting is possible by use of a combine harvester if the crop has matured uniformly.</p>
Justification	Incorrect timing of harvesting and inappropriate harvesting methods leads to losses of sweetpotato. Harvesting before the maturity of the crop results in lower yields and the root does not develop into their maximum size. Delay in harvesting results in fibrous roots or weevil attacked roots or root rots.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> On farm demonstration and training Brochures, leaflets and manuals Seminars to create awareness ICT (WhatsApp groups, websites, mobile apps)
Critical / essential factors for successful promotion	<ul style="list-style-type: none"> Application of all good agronomic practices in sweetpotatoes production (e.g. timely harvesting, correct harvesting) Participatory implementation, stakeholder capacity building and networks. Creating awareness on effects of improper post-harvest handling It is advisable to use at least 3 or more of the maturity indices to have more confidence in the harvest maturity state.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> Farmers – for activity implementation and promotion Extension service (public and private) – technology transfer and dissemination Researchers (KALRO, universities) – establishment of demonstration plots, capacity building of county stakeholders, extension workers and farmers NGOs and CBOs – upscaling of technologies CIGs play the role of adoption of the technologies through their various groups. VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies.
C: Current situation and future scaling up	
Counties where already promoted, if any	Busia, Kakamega, Siaya, Kisumu, Homa bay
Counties where TIMPs will be up scaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> Difficulty in establishing the maturity of sweetpotato Lack of knowledge and appropriate harvesting technology Low uptake before the farmers see the results
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Further research to improve on establishment of maturity of sweetpotato roots Capacity building on appropriate harvesting technology
Lessons learnt in upscaling,	<ul style="list-style-type: none"> Involvement of stakeholders such as CIG, CBOs and NGOs enhances

if any	adoption <ul style="list-style-type: none"> • Continuous capacity building is key to attitude change. Consistent trainings, demonstrations and sensitizations would motivate farmers to adopt the technology
Social, environmental, policy and market conditions necessary for development and upscaling	Policies targeting the empowerment of women and youth as entrepreneurs in society
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased yields and shelf life due to appropriate harvesting techniques
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access credit to purchase the required implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Employment opportunities exist for women who mainly does the task of harvesting
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs and youth have limited access credit to purchase the required implements • VMGs and youth have limited access to education, training and extension services than men • VMGs have less access to agricultural information, technology and knowledge
VMG related opportunities	Adoption of the TIMPs means reduced losses, hence more sweetpotato available for consumption and sale. This will enable VMGs to have enough sweetpotato to consume, hence get micro-nutrients (especially vitamins and minerals).
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Success stories of high demand of sweetpotato in other parts of the country due to its high nutritional value
Application guidelines for users	Brochures, factsheets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO, J. Ndungu, R. Cheboswony (KALRO-Njoro), J. Ndambuki (KALRO-Muguga), F. Wayua (KALRO-Kakamega V. Kirigua and L.Wasilwa (KALRO-HQ).
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • Seed and chemical companies • Universities • Egerton University • Hotels, restaurants, food processing companies • Exporters • HCDA

Research Gaps

- Determination of maturity indices in sweetpotato under different agroecological zones.
- Determination of appropriate harvesting techniques (to minimize incidences of entry of pathogens that would accelerate postharvest deterioration)
- Establishment of estimated basic cost of sweetpotato harvesting management practice

2.8.2. Sorting and grading of sweetpotato

<p>TIMP Name</p>	<p>Sorting and grading of sweetpotato</p>  <p>Sorting and grading of sweetpotato</p> <p>Students sorting and grading sweetpotato</p>
<p>Category (i.e. technology, innovation or management practice)</p>	<p>Management Practice</p>
<p>A: Description of the technology, innovation or management practice</p>	
<p>Problem to be addressed</p>	<p>Poor quality due to mix-up of sweetpotatoes of different grades postharvest (mixing of good quality sweetpotatoes with damaged ones) .Spread of rot-causing microorganisms from good quality to poor quality sweetpotatoes</p>
<p>What is it? (TIMP description)</p>	<p>Sorting Sweetpotato are sorted to remove insect damaged, root rot, cracked and discolored roots Inferior sweetpotato are sorted and packed in clean crates.</p> <p>Grading: Sweetpotatoes are graded based on their external appearances which include size (small, medium and large) for each variety. Good quality sweetpotato should be uniform in appearance and devoid of scars, abrasions, sunburns, decays and other surface defects. Defecting sweetpotatoes as a result of stacking or sweetpotato dropping on the floor mistakenly can be sold at a cheaper price in nearby markets.</p> <p>Preliminary grading of market quality sweetpotato should be done in the field at the time of harvest. Deformed, insect damaged or partially decayed should not be loaded or transported to the market</p>
<p>Justification</p>	<p>Sorting removes insect damaged, root rot, cracked and discolored roots,</p>

	hence reducing the spread of rot-causing microorganisms, hence extends the shelf-life. Graded sweetpotato fetches better prices to the farmer and trader
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders and buyers (households, institutions, hotels, restaurants, food processing companies, hotels)
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures, leaflets and manuals • Seminars to create awareness • ICT (WhatsApp groups, websites, mobile apps)
Critical / essential factors for successful promotion	Favourable policy whereby premium grade is paid higher price
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Extension service (public and private) – technology transfer and dissemination, policy formulation and enforcement • Researchers (KALRO, universities) – establishment of demonstration plots, conduct on-farm research, capacity building of county stakeholders, extension workers and farmers • NGOs and CBOs (FCI, Twiga Foods) – farmer recruitment and mobilization, upscaling of technologies • Exporters and packhouse operators – buying sweetpotatoes from farmers; • Consumers – buying sweetpotato from farmers and traders, hence need for appropriate handling and storage
C: Current situation and future scaling up	
Counties where already promoted, if any	Busia, Kakamega, Siaya, Kisumu, Homa bay
Counties where TIMPs will be up scaled	Migori
Challenges in dissemination	Lack of knowledge on sorting and grading and quality requirements for the export markets
Suggestions for addressing the challenges	Capacity building on grading, sorting and sweetpotato quality requirement
Lessons learnt in upscaling, if any	Proper postharvest handling reduce loss by up to 25%
Social, environmental, policy and market conditions necessary for development and upscaling	Policies targeting the empowerment of women and youth as entrepreneurs in society
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased yields and shelf life due to appropriate harvesting techniques
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women and youth in sorting and grading

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities exist for youth and those recovering from drugs exists in sorting and grading
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Success stories of high demand of sweetpotato in other parts of the country due to its high nutritional value
Application guidelines for users	Brochures, factsheets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO, J. Ndungu, R. Cheboswony (KALRO-Njoro), J. Ndambuki (KALRO-Muguga), F. Wayua (KALRO-Kakamega V. Kirigua and L.Wasilwa (KALRO-HQ).
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • Seed and chemical companies • Universities • Egerton University • Hotels, restaurants, food processing companies • Exporters • HCDA

2.8.3. Curing of sweetpotatoes

TIMP Name	Curing of sweetpotatoes
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Postharvest decay of harvested and stored sweetpotato
What is it? (TIMP description)	<p>Curing is exposing the harvested sweetpotato roots to moderate temperatures of 25-30°C and high humidity (90-95% RH (relative humidity)) for 4-7 days. This helps in toughening of the skin of the roots which protects the root from damage and heals any existing wounds reducing the risk of post-harvest disease infection. Curing can be classified as pre-harvest curing and post -harvest curing</p> <p>Pre-Harvest curing It is a process commonly used with root and tuber crops to heal wounds, protect them against disease, reduce shrinkage and extend storage. This is done by removing the foliage (dehauling) of sweetpotato plants for 2-4 days before harvesting, the post-harvest root losses can be significantly reduced and the shelf-life increased.</p> <p>Post-harvest This happens by exposing the harvested sweetpotato roots to moderate temperatures of 25-30°C and high humidity (90-95% RH (relative humidity)) for 4-7 days, a toughening of the skin of the roots occurs, which helps protect the root from damage and heal any existing</p>

	wounds reducing the risk of post-harvest disease infection
Justification	Curing decreases, the incidence of postharvest diseases such as root rot, reduces water loss during storage, prevents microbial infection and is desirable for development of good scale colour. Curing prolongs the shelf-life and hence enabling better marketing and higher prices
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders and exporters
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures, leaflets and manuals • Seminars to create awareness • ICT (WhatsApp groups, websites, mobile apps)
Critical / essential factors for successful promotion	<ul style="list-style-type: none"> • Application of all good agronomic practices in sweetpotatoes production (e.g. timely harvesting, correct harvesting) • Participatory implementation, stakeholder capacity building and networks. • Creating awareness on effects of improper post-harvest handling • Adequate funding to train on postharvest technology
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Extension service (public and private) – technology transfer and dissemination • Researchers (KALRO, universities) – establishment of demonstration plots, capacity building of county stakeholders, extension workers and farmers • NGOs and CBOs – upscaling of technologies • CIGs play the role of adoption of the technologies through their various groups. • VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies.
C: Current situation and future scaling up	
Counties where already promoted, if any	• Busia, Kakamega, Siaya, Kisumu, Homa bay
Counties where TIMPs will be up scaled	• Migori
Challenges in dissemination	• Lack of awareness of sweetpotato curing technology
Suggestions for addressing the challenges	• Capacity building on curing technology
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Involvement of stakeholders such as CIG, CBOs and NGOs enhances adoption • Continuous capacity building is key to attitude change. Consistent trainings, demonstrations and sensitizations would motivate farmers to adopt the technology
Social, environmental, policy and market conditions necessary for development and upscaling	Policies targeting the empowerment of women and youth as entrepreneurs in society
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	• Not yet determined
Estimated returns	• Increased yields and shelf life due to appropriate curing technology
Gender issues and concerns in development,	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women and youth have limited access to education, training and


dissemination, adoption and scaling up	extension services than men
Gender related opportunities	• Men dominant most decisions at the household and community levels Opportunity exist for youths and women in curing
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity exist for youths and those recovering from drugs in curing
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Success stories of high demand of sweetpotato in other parts of the country due to its high nutritional value
Application guidelines for users	Brochures, factsheets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Njoro P. O. Box 20107, Njoro, Kenya..
Lead organization/scientists	KALRO, J. Ndungu, R. Cheboswony (KALRO-Njoro), J. Ndambuki (KALRO-Muguga), F. Wayua (KALRO-Kakamega V. Kirigua and L.Wasilwa (KALRO-HQ).
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • Seed and chemical companies • Universities • Egerton University • Hotels, restaurants, food processing companies • Exporters • HCDA

Research Gaps

1. Further research on curing machines

2.8.4. Zero energy brick cooler

TIMP Name	<p>Zero energy brick cooler</p>  <p>Zero energy brick cooler</p>
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	 <p>Zero energy brick cooler</p>
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	High postharvest losses caused by lack of cooling technologies for sweetpotato
What is it? (TIMP description)	The Zero Energy Brick Cooler consist of a double brick wall filled with sand in between, and a storage chamber. The sand is kept moist with water. The inside chamber is cooled through evaporation of the water in the sand
Justification	Appropriate cooling reduces postharvest losses and extends shelf-life
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, green grocers, extension workers, women and youth groups, household consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures, leaflets and manuals • Seminars to create awareness • ICT (WhatsApp groups, websites, mobile apps)
Critical / essential factors for successful promotion	<ul style="list-style-type: none"> • The sand should be continuously moist. Cooling is more effective in dry and windy environment; • The cooler can be installed at aggregation centres (collection points).
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers groups to be trained in postharvest handling of the sweetpotato • Scientists and agricultural extension workers- to provide farmers with knowledge on ZECC • CIGs play the role of adoption of the technologies through their various groups. • VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies.
C: Current situation and future scaling up	
Counties where already promoted, if any	Embu, Machakos
Counties where TIMPs will be up scaled	Migori
Challenges in dissemination	Lack of starter capital to construct the cooler
Suggestions for addressing	<ul style="list-style-type: none"> • Avail appropriate financing



the challenges	<ul style="list-style-type: none"> • Capacity building
Lessons learnt in upscaling, if any	Need to continue capacity building of the farmers and users on repair and maintenance of the technology
Social, environmental, policy and market conditions necessary for development and upscaling	To enhance adoption, work with industry, farmer cooperatives, local and regional markets, and bulk purchases to adopt the ZECC
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Low cost
Estimated returns	Reduced postharvest losses, increased income, nutrition
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	The TIMP increases farm income through reduction of harvest losses by pre-cooling the produce. Women can capitalize on this aspect of sweetpotato production to reduce harvest losses
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	Adoption of the TIMPs means reduced losses, hence more sweetpotato available for consumption and sale. There will be more income for the farmers (VMGs)
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Fruit and vegetable farmers in Embu, Kirinyaga, etc. have used the technology to reduce losses and extend shelf-life, hence the marketing time for the vegetables.
Application guidelines for users	Brochures, factsheets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO, J. Ndungu, R. Cheboswony (KALRO-Njoro), J. Ndambuki (KALRO-Muguga), F. Wayua (KALRO-Kakamega V. Kirigua and L.Wasilwa (KALRO-HQ). University of Nairobi: Ambuko J.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • Seed and chemical companies • Universities • Egerton University • Hotels, restaurants, food processing companies • Exporters

- HCDA


Research Gaps

- Determination of shelf life of root roots during cold season

2.8.5. Evaporative Charcoal Cooler

<p>TIMP Name</p>	<p>Evaporative Charcoal Cooler</p>  <p>Evaporative charcoal cooler</p>  <p>Evaporative cooler</p>
<p>Category (i.e. technology, innovation or management practice)</p>	<p>Technology</p>
<p>A: Description of the technology, innovation or management practice</p>	
<p>Problem to be addressed</p>	<p>High postharvest losses caused by lack of cooling technologies for sweetpotato</p>
<p>What is it? (TIMP description)</p>	<p>The Evaporative Charcoal Cooler consist of a double brick wall filled with charcoal in between, and a storage chamber. The charcoal is kept moist with water. The inside chamber is cooled through evaporation of the water in the charcoal.</p>
<p>Justification</p>	<p>Appropriate cooling reduces postharvest losses and extends shelf-life</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<ul style="list-style-type: none"> • Farmers, traders, green grocers, extension workers, women and youth groups, household consumers
<p>Approaches used in dissemination</p>	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures, leaflets and manuals • Seminars to create awareness • ICT (WhatsApp groups, websites, mobile apps)
<p>Critical / essential factors for successful promotion</p>	<ul style="list-style-type: none"> • The charcoal should be continuously moist. Cooling is more effective in dry and windy environment;

	<ul style="list-style-type: none"> The cooler can be installed at aggregation centres (collection points)
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> Farmers groups to be trained in postharvest handling of the sweetpotato Scientists and agricultural extension workers- to provide farmers with knowledge on evaporative charcoal cooler
C: Current situation and future scaling up	
Counties where already promoted, if any	Embu, Kirinyaga
Counties where TIMPs will be up scaled	Migori
Challenges in dissemination	Lack of starter capital to construct the cooler
Suggestions for addressing the challenges	Avail appropriate financing
Lessons learnt in upscaling, if any	Need to continue capacity building of the farmers and users on repair and maintenance of the technology
Social, environmental, policy and market conditions necessary for development and upscaling	To enhance adoption, work with industry, farmer cooperatives, local and regional markets, and bulk purchases to adopt the evaporative charcoal cooler
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Low cost
Estimated returns	Reduced postharvest losses, increased income, nutrition
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women and youth have limited access to productive resources such as land, credit and implements Women and youth have limited access to education, training and extension services than men Women have less access to agricultural information, technology and knowledge Men dominant most decisions at the household and community levels
Gender related opportunities	Employment opportunities exist for women and youth in the operation of the TIMP
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to productive resources such as land, credit, and implements 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	Opportunities exist for youth and those recovering from drugs exists in the operation of the TIMP
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Fruit and vegetable farmers in Embu, Kirinyaga, etc. have used the technology to reduce losses and extend shelf-life, hence the marketing time for the vegetables.
Application guidelines for users	Brochures, factsheets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	

Contacts	The Centre Director, Food Crops Research Centre – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO, J. Ndungu, R. Cheboswony (KALRO-Njoro), J. Ndambuki (KALRO-Muguga), F. Wayua (KALRO-Kakamega V. Kirigua and L.Wasilwa (KALRO-HQ). University of Nairobi: Ambuko J.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • Seed and chemical companies • Universities • Egerton University • Hotels, restaurants, food processing companies • Exporters • HCDA
2.8.6 TIMP Name	Clamp storage
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Losses due to incorrect storage methods
What is it? (TIMP description)	<p>This is a low cost method were the sweetpotatoes are stored in covered tiles.</p> <p>The roots in the best condition are selected, stacked in a heap on a layer of grass, and covered in layers of grass and soil. The structure is then protected with a thatched roof to protect it from sun and rain, a gap is allowed all the way round between the roof and mound for ventilation. A drainage channel is added around the store to divert rainwater</p>  <p>Sweetpotato clamps</p>
Justification	Appropriate storage reduces postharvest losses and extends shelf-life
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures, leaflets and manuals • Seminars to create awareness
Critical / essential factors for successful promotion	The clamp store can be installed at the farm and aggregation centers
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Extension service (public and private) – technology transfer and dissemination • Researchers (KALRO, universities) – establishment of demonstration plots, capacity building of county stakeholders, extension workers and farmers • NGOs and CBOs – upscaling of technologies

	<ul style="list-style-type: none"> • CIGs play the role of adoption of the technologies through their various groups. • VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies.
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMPs will be up scaled	Migori
Challenges in dissemination	Lack of knowledge and appropriate storage methods
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Further research to improve on establishment of clamp storage of sweetpotato roots • Capacity building on the technology
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Involvement of stakeholders such as CIG, CBOs and NGOs enhances adoption • Continuous capacity building is key to attitude change. Consistent trainings, demonstrations and sensitizations would motivate farmers to adopt the technology
Social, environmental, policy and market conditions necessary for development and upscaling	Policies targeting the empowerment of women and youth as entrepreneurs in society
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased yields and shelf life due to appropriate storage methods
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land, credit and implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Men dominant most decisions at the household and community levels
Gender related opportunities	Employment opportunities exist for women and youth in the operation of the TIMP
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and implements • 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	Opportunities exist for youth and those recovering from drugs exists in the operation of the TIMP
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	Brochures, factsheets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2.	Requires validation

Requires validation; 3. Requires further research)	
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO, J. Ndungu, R. Cheboswony (KALRO-Njoro), J. Ndambuki (KALRO-Muguga), F. Wayua (KALRO-Kakamega V. Kirigua and L.Wasilwa (KALRO-HQ).
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • Seed and chemical companies • Universities • Egerton University • Hotels, restaurants, food processing companies • Exporters • HCDA

Research Gaps

- Determination of shelf life of the sweetpotatoes stored in the clamp store

2.8.6. Pit storage

TIMP Name	Pit storage
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Losses due to incorrect storage methods
What is it? (TIMP description)	The pit store requires a hole to be dug in the ground which is lined up with grass to cushion roots from damage and absorb moisture helping to prevent roots from rotting
Justification	Appropriate storage reduces postharvest losses, prevents roots from rotting and extends shelf-life
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures, leaflets and manuals • Seminars to create awareness • ICT (WhatsApp groups, websites, mobile apps)
Critical / essential factors for successful promotion	The pit store can be installed at the farm and aggregation centers
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Extension service (public and private) – technology transfer and dissemination • Researchers (KALRO, universities) – establishment of demonstration plots, capacity building of county stakeholders, extension workers and farmers • NGOs and CBOs – upscaling of technologies • CIGs play the role of adoption of the technologies through their various groups. • VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies.
C: Current situation and future scaling up	



Counties where already promoted, if any	Busia, Kakamega, Siaya, Kisumu, Homa bay	
Counties where TIMPs will be up scaled	Migori	
Challenges in dissemination	Lack of knowledge and appropriate storage methods	
Suggestions for addressing the challenges	Further research to improve on establishment of pit store	
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Involvement of stakeholders such as CIG, CBOs and NGOs enhances adoption • Continuous capacity building is key to attitude change. Consistent trainings, demonstrations and sensitizations would motivate farmers to adopt the technology 	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Policies targeting the empowerment of women and youth as entrepreneurs in society 	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	Not yet determined	
Estimated returns	Increased yields and shelf life due to appropriate storage techniques	
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to productive resources such as land, credit and implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Men dominant most decisions at the household and community levels 	
Gender related opportunities	Employment opportunities exist for women and youth in the operation of the TIMP	
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources such as land, credit, and implements • 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	Opportunities exist for youth and those recovering from drugs exists in the operation of the TIMP	
E: Case studies/profiles of success stories		
Success stories from previous similar projects	Success stories of high demand of sweetpotato in other parts of the country due to its high nutritional value	
Application guidelines for users	Brochures, factsheets and manuals	
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)		Ready for upscaling
G: Contacts		
Contacts	The Centre Director, Food Crops Research Centre – Njoro P. O. Box 20107, Njoro, Kenya.	
Lead organization/scientists	KALRO, J. Ndungu, R. Cheboswony (KALRO-Njoro), J. Ndambuki (KALRO-Muguga), F. Wayua (KALRO-Kakamega V. Kirigua and	

	L.Wasilwa (KALRO-HQ).
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • Seed and chemical companies • Universities • Egerton University • Hotels, restaurants, food processing companies • Exporters • HCDA

Research Gaps

- 1. Determination of shelf life of sweetpotatoes stored in pit store

2.8.7. Packaging of sweetpotatoes (Stackable crates, collapsible crates and wooden crates)

TIMP Name	<p>Packaging of sweetpotatoes (Stackable crates, collapsible crates and wooden crates)</p>  <p>Stackable crates for sweetpotatoes</p>  <p>Harvested sweetpotatoes in crates ready for transportation</p>
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Postharvest losses due to inappropriate packaging of sweetpotatoes
What is it? (TIMP description)	This is a woven baskets, plastic or wooden crates used for packaging sweetpotato; they allow air movement through the sweetpotato. These containers should not be overfilled as this prevents proper stacking and will damage excess roots. The packages should be labelled to show the source of the roots as well as the market destination.
Justification	Proper packaging reduces losses, facilitates handling and increases consumer attraction. Packaging will add some significant cost to the price of the final product
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, retailers, wholesalers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures, leaflets and manuals

	<ul style="list-style-type: none"> • Seminars to create awareness • ICT (WhatsApp groups, websites, mobile apps)
Critical / essential factors for successful promotion	<ul style="list-style-type: none"> • Application of proper packaging • Participatory implementation, stakeholder capacity building and networks. • Creating awareness on effects of over packing
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Extension service (public and private) – technology transfer and dissemination • Researchers (KALRO, universities) – establishment of demonstration plots, capacity building of county stakeholders, extension workers and farmers • NGOs and CBOs – upscaling of technologies • CIGs play the role of adoption of the technologies through their various groups. • VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies.
C: Current situation and future scaling up	
Counties where already promoted, if any	
Counties where TIMPs will be up scaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of knowledge and appropriate packaging technology • Low uptake before the farmers see the results
Suggestions for addressing the challenges	Capacity building on appropriate harvesting technology
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> • Involvement of stakeholders such as CIG, CBOs and NGOs enhances adoption • Continuous capacity building is key to attitude change. Consistent trainings, demonstrations and sensitizations would motivate farmers to adopt the technology
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Policies targeting the empowerment of women and youth as entrepreneurs in society
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased yields and shelf life due to appropriate packaging techniques
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may not have access to resources required for adoption of the enterprise • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Men dominant most decisions at the household and community levels
Gender related opportunities	Employment opportunities exist for the youths in the performing the TIMP
VMG issues and concerns in development, dissemination,	<ul style="list-style-type: none"> • VMG may not easily adopt the technology since it is involving physically

adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and those recovering from drugs in performing the TIMP
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	Brochures, factsheets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, Food Crops Research Centre – Njoro P. O. Box 20107, Njoro, Kenya.
Lead organization/scientists	KALRO, J. Ndungu, R. Cheboswony (KALRO-Njoro), J. Ndambuki (KALRO-Muguga), F. Wayua (KALRO-Kakamega V. Kirigua and L.Wasilwa (KALRO-HQ).
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • Seed and chemical companies • Universities • Egerton University • Hotels, restaurants, food processing companies • Exporters • HCDA

Research Gaps

- Determine appropriate packaging for ease of transportation to distant markets

2.9 VALUE ADDITION OF SWEETPOTATO

2.9.1. Sweetpotato flour


TIMP Name	Sweetpotato flour
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Fresh sweetpotato roots are highly perishable due to their high moisture and sugar content and delicate skin.
What is it? (TIMP description)	Involves cleaning, peeling, trimming, washing, chipping/grating drying milling and packaging of sweetpotato in airtight bags.
	

	(source: Azuri Limited)
Justification	Sweetpotato roots are a highly perishable and difficult to store for prolonged period. They are mostly utilized in its roasted or boiled form. Adding value to sweetpotato roots provides a wide range of products, thus increasing market opportunities. Processing sweetpotato into high quality flour provides opportunities for income generation and employment. Food security will be improved through loss reduction and making food available throughout the year. Farm surpluses and damaged roots unsuitable for sale as fresh produce will not go into waste. Bulkiness will be reduced, thus reducing transport and storage costs. Processing sweetpotato into flour will lead to improved sweetpotato quality in terms of taste, color, flavor and nutritional value. The sweetpotato flour can be blended with other flours and diverse value added products made.to improve consumer acceptability
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on value addition of sweetpotato roots • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	Facilitate long shelf life for the product both in shelf at home and in the market
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted, if any	Bomet, Nakuru, Busia, Elgeyo Marakwet, Kakamega
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination	Cost of solar drying technology and packaging materials will increase cost of the production
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Carrying out adaptive trials to develop and package high quality sweetpotato flour technology • Involving other stakeholders in the manufacturing industry to provide affordable solutions for the drying and packaging technologies. • Capacity building farmers of sweetpotato value addition
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (traders of sweetpotatoes) and consumers, respectively.

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Peeling, drying • Milling equipment • Costs of packaging materials
Estimated returns	Increased income and nutrition through production and sale of high quality sweetpotato flour
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for sweetpotato farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	Women and youth stand to benefit in production, use and sale of sweetpotato flour.
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally produced Sweetpotato flour based products • Nutritious products can be made from Sweetpotato flour contributing to the nutrition of VMGs. • Women can diversify family diet and generate income at village level by making the products for sale
E: Case studies/profiles of success stories	
Success stories	High demand of high quality sweetpotato flour due to nutritional value in other parts of Kenya
Application guidelines for users	High quality sweetpotato flour production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro, P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony, R.J., Ndambuki J., Lucy Kuria, L.W., Ndungu, J. Akoth, H., Wandia, P., Wanjiku, B.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

2.9.2. Sweetpotato crisps


TIMP Name	Sweetpotato crisps
Category (i.e. technology, innovation or management)	Innovation

practice)	
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited sweetpotato food products; high postharvest losses due to high perishability, and low market prices
What is it? (TIMP description)	<p>Fresh sweetpotato roots are cut into thin slices, deep fried in heated cooking oil to a crunchy texture, cooled and package in airtight containers.</p>  <p>Sweetpotato crisps</p>
Justification	Processing of sweetpotato roots into crisps will enhance consumption of sweetpotato, enhance demand and thus encourage increased production. Farm surpluses and damaged roots unsuitable for sale as fresh produce will not go into waste.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of sweetpotato • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality sweetpotato products, availability of quality standards • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process sweetpotato crisps • The government should facilitate affordable credit to empower farmers take up sweetpotato agribusiness
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement
C: Current situation and future scaling up	
Counties where already promoted, if any	Bomet, Nakuru, Kiambu, Kericho

Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> Limited awareness of product by farmers and consumers; limited processing technology at the household level. Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities, limited consumer awareness of value added sweetpotato products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Awareness creation about the product to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the product Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added sweetpotato products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively. There is need for the government to facilitate affordable credit to empower farmers take up sweetpotato agribusiness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet estimated
Estimated returns	<ul style="list-style-type: none"> Reduced loses of excess sweetpotato roots Increased income through production and sale sweetpotato crisps
Gender issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women have less access to information, technology and knowledge Women have less access to land that can be used for sweetpotato farming than men Women and youth have limited access to education, training and extension services than men Men dominant most decisions at the household and community levels
Gender related opportunities	Women and youth stand to benefit in production, use and sale of sweetpotato crisps
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> VMGs have less access to agricultural information, technology and knowledge VMGs have limited access to productive resources such as land, credit, and quality seed VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> Opportunity to produce, trade in, and consume locally produced sweetpotato crisps Nutritious products can be made from Sweetpotato flour contributing to the nutrition of VMGs. Women can diversify family diet and generate income at village level by making the products for sale
E: Case studies/profiles of success stories	

Success stories	Nutritional demand of sweetpotatoes
Application guidelines for users	sweetpotato production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony, R.J., Ndambuki J., Lucy Kuria, L.W., Ndungu, J. Akoth, H., Wandia, P., Wanjiku, B.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

2.9.3. Sweetpotato/wheat chapatti


TIMP Name	Sweetpotato/wheat chapatti
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of sweetpotato roots
What is it? (TIMP description)	<p>Sweetpotato/wheat chapatti made from composite flour of 30% sweetpotato and 70% wheat flour.</p>  <p>Sweetpotato chapatti</p>
Justification	Blending sweetpotato with wheat flour will reduce the cost of chapatti and diversify the use of sweetpotato. This will create demand for increased sweetpotato production for enhanced food security and income generation. It will also save on money used to import wheat
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process • Field days • Shows • Exhibitions, • Farmer Field and Business Schools • Innovation Platforms (IP) • Farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); • availability of high quality sweetpotato roots, availability of quality

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

	<ul style="list-style-type: none"> • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	Women and youth stand to benefit in making and sale of sweetpotato crisps
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally produced sweetpotato crisps • Nutritious products can be made from Sweetpotato flour contributing to the nutrition of VMGs. • Women can diversify family diet and generate income at village level by making the products for sale
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Sweetpotato/wheat chapatti production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony, R.J., Ndambuki J., Lucy Kuria, L.W., Ndungu, J. Akoth, H., Wandia, P., Wanjiku, B.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

2.9.4. Sweetpotato jam


TIMP Name	Sweetpotato jam
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of sweetpotato roots
What is it? (TIMP description)	Jam prepared from sweetpotato mash with addition of sugar and fruit juice

	
	Sweetpotato jam
Justification	Processing of sweetpotato roots into sweetpotato jam will enhance consumption of sweetpotato, enhance demand and thus encourage increased production. Farm surpluses and damaged roots unsuitable for sale as fresh produce will not go into waste. The sweetpotato roots can be processed into jam for both domestic use and sale.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of sweetpotatoes • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high quality sweetpotatoes, availability of quality standards
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties to facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing sweetpotato jam • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – buying sweetpotato jam
C: Current situation and future scaling up	
Counties where already promoted, if any	Bomet, Nakuru, Kericho, Busia, Elgeyo Marakwet, Kakamega
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	Limited awareness of product by farmers and consumers; limited processing technology at the household level. Sweetpotatoes mainly eaten boiled or roasted; Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities,

	limited consumer awareness of value-added sweetpotato products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added sweetpotato products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet estimated
Estimated returns	Increased income through production and sale of sweetpotato jam
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	Women and youth stand to benefit in making and marketing of the jam hence earn more income
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunity for the VMGs exist in making, trading and consuming the locally produced sweet potato jam • VMGs can benefit in marketing sliced and packaged fruits hence earn more income
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Sweetpotato jam production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony, R.J., Ndambuki J., Lucy Kuria, L.W., Ndungu, J. Akoth, H., Wandia, P., Wanjiku, B.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments)

	<ul style="list-style-type: none"> • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters
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2.9.5. Sweetpotato Mandazi

TIMP Name	Sweetpotato Mandazi
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of sweetpotato roots
What is it? (TIMP description)	<p>Sweetpotato/wheat mandazi made from composite flour of 25% sweetpotato and 75% wheat flour.</p>  <p>Sweetpotato mandazi</p>
Justification	Blending sweetpotato with wheat flour will reduce the cost of mandazi and diversify the use of sweetpotato. This will create demand for increased sweetpotato production for enhanced food security and income generation. It will also save on money used to import wheat
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of sweetpotato • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high quality sweetpotatoes, availability of quality standards
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – sweetpotato mandazi • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing/buying sweetpotato mandazi
C: Current situation and future scaling up	

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

	<p>VMGs hence bettering their health and incomes.</p> <ul style="list-style-type: none"> The micro-nutrients in sweetpotato mandazi are particularly healthy for persons who suffer from gluten intolerance.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Sweetpotato mandazi production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Rosemary J. Cheboswony, John Ndungu, Benjamin Kivuva, Fredah Maina, Violet Kirigwa (KALRO HQTs), David Lelgut, James Ndambuki, Harun, (KALRO Muguga South)
Partner organizations	<ul style="list-style-type: none"> MoALFC (County Governments) CBOs and NGOs Hotels, restaurants, food processing companies Exporters


2.9.6. Sweetpotato buns

TIMP Name	Sweetpotato buns
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of sweetpotato roots
What is it? (TIMP description)	<p>Sweetpotato/wheat buns made from composite flour of 25% sweetpotato and 75% wheat flour.</p>  <p>Sweetpotato buns</p>
Justification	Blending sweetpotato with wheat flour will reduce the cost of buns and diversify the use of sweetpotato. This will create demand for increased sweetpotato production for enhanced food security and income generation. It will also save on money used to import wheat
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	On-farm experimentation and practical demonstration of preparation process, field days, shows, exhibitions, Farmer Field and Business Schools, Innovation Platforms (IPs), farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high quality sweetpotato roots, availability of quality standards. Farmers should organize themselves into growers' associations which

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

Gender related opportunities	Women and youth stand to benefit in production, use and sale of sweetpotato buns
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made sweetpotato buns • Sweetpotato mandazi can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes. • The micro-nutrients in sweet sweetpotato mandazi are particularly healthy for persons who suffer from gluten intolerance.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	sweetpotato buns production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony, R.J., Ndambuki J., Lucy Kuria, L.W., Ndungu, J. Akoth, H., Wandia, P., Wanjiku, B.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters

2.9.7. Sweetpotato fritters

TIMP Name	Sweetpotato fritters
	Innovations
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of sweetpotato roots
What is it? (TIMP description)	<p>Grated fresh sweetpotato roots combined with wheat flour, eggs and spices. The combination id deep fries, cooled and packaged.</p>  <p>Sweetpotato fritters</p>
Justification	Diversification of sweetpotato products will enhance consumption of

	sweetpotato, enhance demand and thus spur increased production.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers.
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of sweetpotato roots • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high quality sweetpotatoes, availability of quality standards.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing commercial sweetpotato fritters • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – Prepare/buying sweetpotato fritters
C: Current situation and future scaling up	
Counties where already promoted, if any	Bomet, Nakuru
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	Limited awareness of product by farmers and consumers; limited processing technology at the household level. Sweetpotatoes are mainly utilized in roasted and boiled forms; Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities, limited consumer awareness of value added sweetpotato products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors. • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added sweetpotato products; nutrition education to consumers
Lessons learnt in upscaling, if any	• A good value added product will penetrate the market very fast.
Social, environmental,	• Target women and youth as entrepreneurs in society who are the major

policy and market conditions necessary for development and upscaling	adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased income and nutrition from sale and consumption of sweetpotato fritters
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for sweetpotato farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	Women and youth stand to benefit in production, use and sale of sweetpotato fritters
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made sweetpotato fritters • Sweetpotato fritters can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes. • The micro-nutrients in sweet sweetpotato fritters are particularly healthy for persons who suffer from gluten intolerance.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Sweetpotato fritters production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony, R.J., Ndambuki J., Lucy Kuria, L.W., Ndungu, J. Akoth, H., Wandia, P., Wanjiku, B.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

2.9.8. Sweetpotato chips/fries


TIMP Name	Sweetpotato chips/fries
Category (i.e. technology, innovation or management practice)	Innovation

A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited sweetpotato utilization food products; high postharvest losses due to high perishability, and low market prices
What is it? (TIMP description)	Sweetpotatoes are peeled then cut into chips, deep fried and served hot  Sweetpotatoes chips
Justification	Sweetpotato utilization is limited to boiling and roasting. Diversification of sweetpotato roots will enhance consumption of sweetpotato, enhance demand and thus encourage increased production. Adding value to sweetpotato roots will also minimize wastage of farm surpluses and damaged roots unsuitable for sale as fresh produce. The sweetpotato roots can be processed into chips for both domestic use and sale.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of sweetpotato • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high-quality sweetpotato products, availability of quality standards; • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process sweetpotatoes into various products; the government should facilitate affordable credit to empower farmers take up sweetpotato agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement
C: Current situation and future scaling up	
Counties where already promoted, if any	Bomet, Nakuru, Kericho, Busia, Elgeyo Marakwet, Kakamega
Counties where TIMPs will be up scaled	Migori

Challenges in development and dissemination	<ul style="list-style-type: none"> Limited awareness of product by farmers and consumers; limited processing technology at the household level. Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities, limited consumer awareness of value added sweetpotato products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Awareness creation about the product to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the product Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added sweetpotato products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value-added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively. There is need for the government to facilitate affordable credit to empower farmers take up sweetpotato agribusiness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet estimated
Estimated returns	<ul style="list-style-type: none"> Reduced loses of excess sweetpotato roots Increased income through production and sale sweetpotato crisps
Gender issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women have less access to information, technology and knowledge Women have less access to land that can be used for sweetpotato farming than men Women and youth have limited access to education, training and extension services than men Men dominant most decisions at the household and community levels
Gender related opportunities	Women and youth stand to benefit in production, use and sale of sweetpotato chips
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> VMGs have less access to agricultural information, technology and knowledge VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness
VMG issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> Opportunity to produce, trade in, and consume locally made sweetpotato chips Sweetpotato chips can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes. The micro-nutrients in sweet sweetpotato chips are particularly healthy for persons who suffer from gluten intolerance.
VMG related opportunities	<ul style="list-style-type: none"> Women have less access to information, technology and knowledge Women have less access to land that can be used for sweetpotato farming than men Women and youth have limited access to education, training and extension services than men

	<ul style="list-style-type: none"> Men dominant most decisions at the household and community levels
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Sweetpotato crisps production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony R.J., Ndambuki J., Lucy Kuria L.W., Ndungu J. Akoth H., Wandia P., Wanjiku B.
Partner organizations	<ul style="list-style-type: none"> MoALFC (County Governments) CBOs and NGOs Hotels, restaurants, food processing companies Exporters

2.9.9. Sweetpotato/wheat noodles

TIMP Name	Sweetpotato/wheat noodles
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of sweetpotato roots
What is it? (TIMP description)	<p>Sweetpotato/wheat noodles made from composite flour of 25% sweetpotato and 75% wheat flour.</p>  <p>Sweetpotato noddles</p>
Justification	Blending sweetpotato with wheat flour will reduce the cost of noodles and diversify the use of sweetpotato. This will create demand for increased sweetpotato production for enhanced food security and income generation. It will also save on money used to import wheat
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	On-farm experimentation and practical demonstration of preparation process, field days, shows, exhibitions, Farmer Field and Business Schools, Innovation Platforms (IPs), farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP);

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

in development and dissemination	<ul style="list-style-type: none"> • Women have less access to land that can be used for sweetpotato farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	Women and youth stand to benefit in production, use and sale of sweetpotato noodles
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made sweetpotato noodles • Sweetpotato mandazi can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes. • The micro-nutrients in sweet sweetpotato noodles are particularly healthy for persons who suffer from gluten intolerance.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Sweetpotato noodles production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Require validation
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony R.J., Ndambuki J., Lucy Kuria L.W., Ndungu J. Akoth, H., Wandia P., Wanjiku B.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

2.9.10. Sweetpotato/wheat doughnuts


TIMP Name	Sweetpotato/wheat doughnuts
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of sweetpotato roots
What is it? (TIMP description)	Sweetpotato/wheat made from composite flour of 25% sweetpotato and 75% wheat flour.

	 <p>Sweetpotato doughnut</p>
Justification	Blending sweetpotato with wheat flour will reduce the cost of doughnuts and diversify the use of sweetpotato. This will create demand for increased sweetpotato production for enhanced food security and income generation. It will also save on money used to import wheat
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	On-farm experimentation and practical demonstration of preparation process, field days, shows, exhibitions, Farmer Field and Business Schools, Innovation Platforms (IPs), farmer exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high quality sweetpotato roots, availability of quality standards. • Farmers should organize themselves into growers' associations which facilitate setting up of factories to process sweetpotatoes into various products; the government should facilitate affordable credit to empower farmers take up sweetpotato agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • Processors – processing of sweetpotato doughnuts • VMGs will benefit from the grants as they adopt the technologies. They are the recipients of the technologies. • Government regulatory agencies (e.g. KEBS) – quality standards formulations and enforcement • Consumers – preparing and/or buying sweetpotato doughnuts
C: Current situation and future scaling up	
Counties where already promoted, if any	Bomet, Nakuru
Counties where TIMPs will be upscaled	Migori
Challenges in development and dissemination	Limited awareness of product by farmers and consumers; limited processing technology at the household level. Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities, limited consumer awareness of value added sweetpotato products
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the product to farmers, consumers and other value chain actors.

	<ul style="list-style-type: none"> • Capacity building of farmers on how to prepare the product • Information dissemination – postharvest handling, value addition, and nutritional attributes of the product • Involvement of regulatory agencies and policy makers in upscaling process, linkage to credit facility providers to promote commercialization, advocacy for standards development for value added sweetpotato products; nutrition education to consumers
Lessons learnt in upscaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and upscaling	Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased income and nutrition from sale and consumption of sweetpotato biscuits
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for sweetpotato farming than men • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of sweetpotato doughnuts
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made sweetpotato doughnuts • Sweetpotato doughnuts can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes. • The micro-nutrients in sweet sweetpotato doughnuts are particularly healthy for persons who suffer from gluten intolerance.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	sweetpotato doughnuts production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony R.J., Ndambuki J., Lucy Kuria L.W., Ndungu J. Akoth, H., Wandia P., Wanjiku B.

Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters
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2.9.11. Sweetpotato juice

TIMP Name	Sweetpotato juice
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of sweetpotato roots
What is it? (TIMP description)	<p>Sweetpotato juice prepared from orange fleshed sweetpotato puree</p>  <p>Sweetpotato juice</p>
Justification	Sweetpotato utilization is limited to boiling and roasting. Diversification of sweetpotato roots will enhance consumption of sweetpotato, enhance demand and thus encourage increased production. Adding value to sweetpotato roots will also minimize wastage of farm surpluses and damaged roots unsuitable for sale as fresh produce. The sweetpotato roots can be processed into juice for both domestic use and sale.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of sweetpotatoes • Seminars to create awareness • Farmer exchange visits and study tours • Capacity building – Common Interest Groups (CIG) • Establishment of collection centres • ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high quality sweetpotatoes, availability of quality standards
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • Agricultural extension and advisory services will offer technical advisory services to the farmers. • Counties to facilitate the extension staff and provide grants to the farmers. • CIGs play the role of adoption of the technologies through their various

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

	juice
	<ul style="list-style-type: none"> • Sweetpotato juice can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes. • The micro-nutrients in sweet sweetpotato juice are particularly healthy for persons who suffer from gluten intolerance.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Sweetpotato juice production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony R.J., Ndambuki J., Lucy Kuria L.W., Ndungu J. Akoth, H., Wandia P., Wanjiku B.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs • Hotels, restaurants, food processing companies • Exporters

2.9.12. Sweetpotato Biscuits

TIMP Name	Sweetpotato Biscuits
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited utilization of sweetpotato roots
What is it? (TIMP description)	<p>Sweetpotato/wheat biscuits made from composite flour of 25% sweetpotato and 75% wheat flour.</p>  <p>Sweetpotato biscuits</p>
Justification	Blending sweetpotato with wheat flour will reduce the cost of biscuits and diversify the use of sweetpotato. This will create demand for increased sweetpotato production for enhanced food security and income generation. It will also save on money used to import wheat
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and practical demonstration of preparation process, field days, shows, exhibitions, Farmer Field and Business Schools, Innovation Platforms (IPs), farmer exchange visits
Critical/essential factors for	<ul style="list-style-type: none"> • Participatory implementation, stakeholder capacity building and

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

dissemination	<p>than men</p> <ul style="list-style-type: none"> • Women and youth have limited access to education, training and extension services than men • Men dominant most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Women and youth stand to benefit in production, use and sale of sweetpotato biscuits
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunity to produce, trade in, and consume locally made sweetpotato biscuits • Sweetpotato biscuits can be used to make cheap nutritious food products, which will lead to enhanced production and consumption by VMGs hence bettering their health and incomes. • The micro-nutrients in sweet sweetpotato biscuits are particularly healthy for persons who suffer from gluten intolerance.

E: Case studies/profiles of success stories

Success stories	
Application guidelines for users	sweetpotato biscuits production leaflets and manuals

F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research) Ready for upscaling

G: Contacts

Contacts	The Centre Director, KALRO-Njoro; P. O. Private Bag 20107, Njoro. Email: kalro.njoro@kalro.org, Tel: 020-3510865.
Lead organization/scientists	KALRO-Njoro, Cheboswony, R.J., Lucy Kuria, L.W., Ndungu, J. Akoth, H., Wandia, P., Wanjiku, B.
Partner organizations	<ul style="list-style-type: none"> • MoALFC (County Governments) • CBOs and NGOs (e.g.) • Hotels, restaurants, food processing companies • Exporters


Research gaps

- There is limited information on nutritional profiling of value added sweetpotato products, hence need for elaborate research on sweetpotato flour blending with legumes and cereals to determine nutrition value and optimum blending ratios.
- There is need to research on food quality and safety of value added sweetpotato products.

2.10 MECHANIZATION OF SWEETPOTATO PRODUCTION ACTIVITIES

2.10.1. Plough


TIMP Name	Plough
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • Slow and tedious processes of seedbed preparation, in a commercialized Sweetpotatoes commodity

	<ul style="list-style-type: none"> • Reduced capacity due to manual digging drudgery • High cost of manual labour
What is it? (TIMP description)	 <ul style="list-style-type: none"> • Mould board plough is the most efficient tillage implement for seed bed preparation and weed eradication. A plough that has a mouldboard, coulter, which a sharp steel wedge that precedes the plough and cuts vertically through the soil.
Justification	<ul style="list-style-type: none"> • High Efficiency. When well-adjusted, the plough automatically seeks the desired depth by itself. • Versatility. The various models have different features that enable high efficiency in preparation of the land. • Pest Control. • Improves Soil Health.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Sweetpotatoes farmers and researchers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Field Demonstrations and training, Agricultural shows (ASK) and other exhibitions
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and adopt if appropriate • A platform for interaction of sweetpotatoes value chain stakeholders • Timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO, Universities (for information) • Machinery fabricators • NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of sweetpotatoes innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of appropriate machines for different farm activities • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Sweetpotatoes innovation platforms • Acquisition of the machines on special terms • Avail facilitation to demonstration site • Build capacity through efficient agricultural production to afford the cost
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms

	<ul style="list-style-type: none"> • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 840,000
Estimated returns	KES 150,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crop production activities, therefore the implement will reduce their drudgery of work • Women and youth have limited access credit to purchase the required implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to credit to purchase farm implements such as a mould plough • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as sweetpotato, wheat, finger millet and rice
Application guidelines for users	Demonstrations and training and User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani, P.O. Box 340. Machakos, Email: cd.katumani@kalro.org , Phone: 0711369535
Lead organization/scientists	KALRO, Egerton University Nasirembe W, Pole F.N.
Partner organizations	Local Fabricators

2.10.2. Harrow


TIMP Name	Harrow
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Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • Slow and tedious processes of land preparation, in a commercialized Sweetpotatoes commodity • Reduced capacity due to manual digging drudgery • High cost of manual labour
What is it? (TIMP description)	<ul style="list-style-type: none"> • Creating of a crumbly layer for planting is tedious. It is not possible to manually protect the soil surface from rapid drying. • Improving both the air and water penetrability into soil manually can be too expensive if manually undertaken. • Manual operation will reduce microbiological processes in the soil. • Manual land harrowing Improving of nutrient availability to plants.
Justification	<ul style="list-style-type: none"> • It has multiple uses and other advantages, light can be used in tree pruning and bush clearing • Preparation through cutting and burying the trash for decomposition. • Farm sizes less than one hectare may limit manoeuvrability of brushers • Manual labour is costly
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Sweetpotatoes farmers and researchers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Field Demonstrations and training, Agricultural shows (ASK) and other exhibitions
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and adopt if appropriate • A platform for interaction of sweetpotatoes value chain stakeholders • Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO, Universities (for information) • Machinery fabricators • NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of sweetpotatoes innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of appropriate machines for different farm activities • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Sweetpotatoes innovation platforms • Acquisition of the machines by investors

	<ul style="list-style-type: none"> • Avail facilitation to demonstration site • Build capacity through efficient agricultural production to afford the cost
Lessons learnt in upscaling if any	•
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 450,000
Estimated returns	KES 150,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access credit to purchase the required implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	• Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to credit to purchase farm implements such as a mould plough • 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	• Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as sweetpotato, wheat, finger millet and rice
Application guidelines for users	Demonstrations and training and User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani, P.O. Box 340. Machakos, Email: cd.katumani@kalro.org , Phone: 0711369535
Lead organization/scientists	KALRO, Egerton University Nasirembe W, Pole F.N.
Partner organizations	Local Fabricators

2.10.3. Ridger


TIMP Name	Ridger
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Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • Slow and tedious processes of ridging, in a commercialized Sweetpotatoes commodity • Difficult to prepare a uniform fine tilth seedbed manually • Delayed operation lead to late planting • Low acreage because of lack of manual labour • High cost of manual labour
What is it? (Description of the TIMP)	<ul style="list-style-type: none"> • The Ridger is used for making ridges for row crops such as sugercane, Potato, chillies, tobacco, banana etc. as well as for opening furrows for water flow. • The ridger should be used when the soil is slightly moist and used only after tilling the land once or twice.
Justification	<ul style="list-style-type: none"> • Controlled Traffic: After ridges are established, all field traffic is confined to the furrows between the ridges. • Ridge-till is considered to be a form of conservation tillage since approximately 65% of the residues remain on the surface after planting • By the time cultivation is necessary, the crop canopy is able to buffer the impact of intense rainfall. • After harvest, all crop residues remain on the surface till planting the following spring. • Early Soil Warmup: Planting in ridges with the residue removed over the seed allows the soil to dry and warm faster in the spring compared to the no-till system • Reduced Herbicide Cost:
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Sweetpotatoes farmers and researchers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Field Demonstrations and training, Agricultural shows (ASK) and other exhibitions
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved sweetpotatoes varieties • A platform for interaction of sweetpotatoes value chain stakeholders • Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	<p>KALRO, Universities (for information)</p> <p>Machinery fabricators</p> <p>NGO supporting farmers for dissemination</p>

C: Current situation and future scaling up	
Counties where already promoted if any	Kwale, Kilifi, Lamu, Tana-River, Makueni, Kitui, Baringo
Counties where TIMP will be up scaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of sweetpotatoes innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of machines • Lack of facilitation to demonstration site • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Sweetpotatoes innovation platforms • Acquisition of the machines • Lack of facilitation to demonstration site • Build capacity through efficient agricultural production to afford the cost
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 280,000
Estimated returns	KES 180,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access credit to purchase the required implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to credit to purchase farm implements such as a ridger • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as sweetpotato, wheat, finger millet and rice
Application guidelines for users	Demonstrations and training and User manuals

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos, Email: cd.katumani@kalro.org , Phone: 0711369535
Lead organization/scientists	KALRO, Egerton University Nasirembe W,
Partner organizations	Local Fabricators


2.10.4. Planter

TIMP Name	Planter
Category (technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • High and increasing cost of manual labour. • Manual hole digging increases the cost of making planting holes. • It is slow and tedious processes. • It is also difficult to prepare a uniformly spaced contour ridges. • Delayed operation lead to late planting. • Manual hole digging increases the cost of hole making.
What is it? (TIMP description)	
Justification	<ul style="list-style-type: none"> • Manual planting increase the amount of seed used and may require thinning • Fertilizer use is not evenly distributed when manually applied • Kales seed is small making planting depth critical and difficult to attain when manually done and seed shallowly planted will germinate with poor yields • Raw planting increases yields, easy to manage weeds and pests, and more importantly timely uniform and low labour requirement,
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Sweetpotatoes farmers and researchers
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Field Demonstrations and training, Agricultural shows (ASK) and other exhibitions
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved sweetpotatoes varieties • A platform for interaction of sweetpotatoes value chain stakeholders • Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for	KALRO, Universities (for information)

scaling up and their roles	Machinery fabricators NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Lamu
Counties where TIMP will be up scaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of sweetpotatoes innovation platforms to facilitate interaction of farmers with relevant stakeholders • Lack of machines • Lack of facilitation to demonstration site • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Sweetpotatoes innovation platforms • Acquisition of the machines • Lack of facilitation to demonstration site • Build capacity through efficient agricultural production to afford the cost
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 400,000 (power auger digger), KES 80,000 (Tractor mounted hole digger)
Estimated returns	KES 50,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crop production activities, therefore the implement will reduce their drudgery of work • Women and youth have limited access credit to purchase the required implements • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and men in operating the the implement
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to credit to purchase farm implements such as a planter • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from	Mechanization has enabled increased production in other crops such as

previous similar projects	sweetpotato, wheat, finger millet and rice
Application guidelines for users	User manuals and leaflets
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO-Katumani, P.O. Box 340. Machakos, Email: cd.katumani@kalro.org , Phone: 0711369535
Lead organization/scientists	KALRO, Egerton University Nasirembe W,
Partner organizations and contacts	Local Fabricators


2.10.5. Motorised Sprayer

TIMP Name	Motorised Sprayer  <table border="1"> <caption>Nozzle Guide for Band and Directed Spraying</caption> <thead> <tr> <th></th> <th>Even Flat Fan</th> <th>Two Even Flat Fan</th> <th>Hollow Cone</th> <th>Full Cone</th> <th>Disc and Core Cone</th> </tr> </thead> <tbody> <tr> <td>Herbicides</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Pre-emerge</td> <td>Very Good</td> <td>Good</td> <td></td> <td>Good</td> <td></td> </tr> <tr> <td>Post-emerge Contact</td> <td>Good</td> <td>Very Good</td> <td>Very Good</td> <td></td> <td></td> </tr> <tr> <td>Post-emerge Systemic</td> <td>Very Good</td> <td>Good</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Fungicides</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Contact</td> <td>Good</td> <td></td> <td>Good</td> <td></td> <td>Very Good</td> </tr> <tr> <td>Systemic</td> <td>Very Good</td> <td></td> <td></td> <td></td> <td>Good</td> </tr> <tr> <td>Insecticides</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Contact</td> <td></td> <td>Very Good</td> <td>Very Good</td> <td></td> <td>Very Good</td> </tr> <tr> <td>Systemic</td> <td>Very Good</td> <td></td> <td></td> <td></td> <td>Good</td> </tr> <tr> <td>Growth Regulators</td> <td>Good</td> <td></td> <td></td> <td>Very Good</td> <td></td> </tr> </tbody> </table>		Even Flat Fan	Two Even Flat Fan	Hollow Cone	Full Cone	Disc and Core Cone	Herbicides						Pre-emerge	Very Good	Good		Good		Post-emerge Contact	Good	Very Good	Very Good			Post-emerge Systemic	Very Good	Good				Fungicides						Contact	Good		Good		Very Good	Systemic	Very Good				Good	Insecticides						Contact		Very Good	Very Good		Very Good	Systemic	Very Good				Good	Growth Regulators	Good			Very Good	
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Growth Regulators	Good			Very Good																																																																					
Category (technology, innovation or management practice)	Technology																																																																								
A: Description of the technology, innovation or management practice																																																																									
Problem to be addressed	Slow and tedious processes of manual spraying of Cashew; The height of the tree requires a long projectile spray; Sweetpotato has a high number of pests that invade leaf, flowers and nut.																																																																								
What is it? (TIMP description)	A motorized sprayer is a device used to spray a liquid, where sprayers are commonly used for projection of water, weed killers, crop performance materials, pest maintenance chemicals, as well as manufacturing and production line ingredients. In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides, and fertilizers on agricultural crops. Sprayers are man-portable units typically backpacks with spray guns They are used to control; weeds that can harbour insects by use of herbicides, insect pests that can cause diseases by the use of insecticides as well as pesticides. Control of fungal diseases by the use of fungicides. Application of micronutrients on the plants, boron including as well as foliar fertilizers.																																																																								
Justification	Pest reduce yields up to 98% and are a major menace in agricultural production. Before Sweetpotatoes forms a canopy, broad leafed weeds compete with sweetpotatoes seedling for nutrients and light greatly reducing their yield. Manual sprayers are labour intensive and spraying																																																																								

	labour is too expensive. It has lower pressure reducing its efficiency.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Sweetpotatoes Farmers and agribusiness entrepreneurs
Approaches used in dissemination	<ul style="list-style-type: none"> Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Field Demonstrations and training, Agricultural shows (ASK) and other exhibitions
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Applied and adaptive Research to test, validate and release improved sweetpotatoes varieties A platform for interaction of sweetpotatoes value chain stakeholders Use by Farmers
Partners/stakeholders for scaling up and their roles	Machinery fabricators NGO supporting farmers (AGRA)
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Taita Taveta, Lamu
Counties where TIMP will be up scaled	Migori
Challenges in dissemination	<ul style="list-style-type: none"> Lack of sweetpotatoes innovation platforms to facilitate interaction of farmers with relevant stakeholders Relatively high cost for individual small-scale farmer. Limited awareness of the existence of machine among some farmers.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Establish Sweetpotatoes innovation platforms Encourage group/cooperative ownership Launch and awareness campaign through demonstrations and trainings
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. Good Policy on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Motorized sprayer 55,000 KES per unit
Estimated returns	KES 180,000.00/year
Gender issues and concerns in development, dissemination, adoption and scaling up dissemination	<ul style="list-style-type: none"> Women have less access to farm implements such as the motorized sprayer than men Women and youth have limited access credit to purchase the required chemicals Women and youth have limited access to education, training and extension services than men Women have less access to agricultural information, technology and knowledge
Gender related opportunities	<ul style="list-style-type: none"> Employment opportunities exist for youth in operating the the implement
VMG issues and concerns in development, dissemination,	<ul style="list-style-type: none"> VMGs have less access to farm implements such as the motorized sprayer than men

adoption	<ul style="list-style-type: none"> • VMGs have limited access credit to purchase the required chemicals • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as sweetpotato, wheat, finger millet and rice
Application guidelines for users	User manuals and leaflets
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research)	
G: Contacts	
Contacts	The Institute Director, KALRO-Katumani, P.O. Box 340. Machakos, Email: cd.katumani@kalro.org , Phone: 0711369535
Lead organization/scientists	KALRO, Egerton University Nasirembe W,
Partner organizations and contacts	Local Fabricators
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	
Estimated returns	KES 180,000.00/year
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	Motorized sprayer designed for easy start and operation. Men have been drawn to spraying by the machine. This task was predominantly for women before the introduction of the machine.
Gender related opportunities	Creates employment at production, transportation, processing and distribution
Gender related opportunities	
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Facilitation to access information • Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as sweetpotato, wheat, finger millet and rice
Application guidelines for users	
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO-Katumani, P.O. Box 340. Machakos, Email: cd.katumani@kalro.org , Phone: 0711369535
Lead organization/scientists	KALRO, Egerton University Nasirembe W,
Partner organizations and contacts	Local Fabricators

2.10.6. Sweetpotato Harvester

TIMP Name	Sweetpotato harvester 
Category (technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • Lack of sweetpotatoes grafted planting material • High cost of labour • Manual labour is diminishing • Slowness in manual Sweetpotatoes seedlings grafting
	<ul style="list-style-type: none"> • Mainly used for harvesting potato, garlic, sweetpotatoes, carrots, peanuts and other crops, underground rhizomes. • The harvest efficiency, does not hurt the skin, can be harvested with a seedling, light and vibration-free operation, no blocking grass, earth leakage fast, simple structure, long service life. • Most important is that we can extract the mechanical soil remaining plastic, does not affect crop growth next quarter..
Justification	<ul style="list-style-type: none"> • The machine works faster • The machine is consistent in cut angle • The cutting blades are automatically disinfected after each cycle • Allows grafting of small plants • Cost effective
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Sweetpotatoes Farmers and agribusiness entrepreneurs
Approaches used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved sweetpotatoes varieties • A platform for interaction of sweetpotatoes value chain stakeholders • Use by Farmers
Partners/stakeholders for scaling up and their roles	Machinery fabricators NGO supporting farmers (AGRA)
C: Current situation and future scaling up	
Counties where already promoted if any	Not yet promoted
Counties where TIMP will be up scaled	Migori
Challenges in dissemination	Lack of sweetpotatoes innovation platforms to facilitate interaction of farmers with relevant stakeholders

Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Sweetpotatoes innovation platforms • Encourage group/cooperative ownership • Launch and awareness campaign through demonstrations and trainings
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. • Good Policy on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	<ul style="list-style-type: none"> • Women perform most of the harvesting g activities, therefore the implement will reduce their drudgery of work when available • Women have less access to farm implements such as the sweetpotato harvester than men • Women and youth have limited access credit to purchase the required chemicals • Women and youth have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge
Gender related opportunities	Employment opportunities exist for youth in operating the the implement
VMG issues, concern in development	<ul style="list-style-type: none"> • VMGs have less access to farm implements such as the sweetpotato harvester than men • VMGs have limited access credit to purchase the required chemicals • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	• Opportunities exist for unemployed youth in operating the the implement
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as sweetpotato, wheat and rice
Application guidelines for users	User manuals and leaflets
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Institute Director, KALRO-Katumani, P.O. Box 340. Machakos Email: cd.katumani@kalro.org , Phone: 0711369535
Lead organization/scientists	
Partner organizations and contacts	Tecsols Ltd – Nakuru

2.11 AGRICULTURAL BUSINESS AND MARKETING

2.11.1. Models for market-oriented production of sweetpotato

TIMP Name	Models for market-oriented production of sweetpotato
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Sweetpotato production is often not demand driven, hence the lack of drivers subsequently leads to limited market access
What is it? (TIMP description)	An approach to organize sweetpotato production based on market orientation. Producer-driven model is based on production organized by the producers themselves. Buyer-driven model is based on production organized by the end customer companies. Intermediary-driven model is based on the production organized by an intermediary such as extension, NGOs, Research institutions, etc.
Justification	Understanding the market demand for various sweetpotato products is crucial in helping farmers select the procedures and the products to engage in to meet the market demand and subsequently make profit from sweetpotato production. Without appropriate approach, access to market will remain a major limitation, leading to further decline in production and income
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, processing industries, Extension, NGOs, Research institutions
Approaches to be used in dissemination	Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of investors • Better/guaranteed higher prices of sweetpotato
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – investments in production of improved sweetpotato and clean planting material; market surveys • County extension staff – Organization of farmers and technical service delivery; capacity building • NGOs – Organization of farmers and service delivery; capacity building • Private sector (local traders and exporters) – Support in input services and providing markets for sweetpotato products • Research institutions – Availing improved planting material, backstopping
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Discontinuous and geographically fragmented supply • Small-scale production • Short market distance due to bulkiness and high perishability – • Limited information on sweetpotato markets • Limited link of farmers to markets – disorganized marketing system

	<ul style="list-style-type: none"> • Limited investment by buyers • Level of policy support for market development • Poor quality produce
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Discontinuous and geographically fragmented supply – Formation of marketing groups • Small-scale production – Aggregation of production • Short market distance due to bulkiness and high perishability – Link with buyers/marketing groups • Limited information on sweetpotato markets – capacity building on access to information • Limited investment by buyers – County government support; establishment of innovation platforms • Level of policy support – value chain support platform (e.g. producers’ association); implementation of product standardization; financing/access to credit; subsidies, inputs support, standardization in price/weights aspect • Poor quality produce – information on market demand; demand driven market linkages
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • High marketing costs due to bulkiness of produce • Bulky nature and high perishability coupled by small scale production challenge market development • Individual marketing instead of collective marketing
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – acceptability of improved practices by the farmers, group dynamics, cultures • Environmental conditions – Enhancing natural resource management • Policy conditions – Policy support in extension, inputs, prices, production organizations (cooperatives), infrastructure, investment environment
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The cost of producing sweetpotato include purchase of vines, application of manure and labour costs, which is about KES.51,500 per acre. Basic seed (vines) costs KES.2/vine while pre-basic seed for clean seed multiplication costs KES.20/vine @ 11,000 vines per acre. Cost of accessing market information would be approximately KES.500 per month (KES.3,000 per season) • In a sack (vertical garden), costs of producing sweetpotato
Estimated returns	<ul style="list-style-type: none"> • Under good management, an acre of land can produce between 7,700 – 11,000 kg of sweetpotatoes and between 20,000 – 25,000 vines • Packaged in 110-kg per bag, the sweetpotato can fetch a price of KES.1,000 per bag, while the vines can be sold at KES.1/vine giving a gross margin per acre of between KES.87,000 – KES.122,000 under good management
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Women are widely discriminated in rural producer organizations • Women also have limited participation and influence in rural producer organizations • Socio-cultural norms may limit women’s participation and leadership in groups • Women’s double and triple roles means they may not have time to participate • Women’s status, age, wealth level may influence participation • Limited access to assets, resources and services, required to join

	<ul style="list-style-type: none"> producer groups In some cultures women may not be able to travel away from their homes to producer group meetings, without permission Strict rules of entry and requirements of producers' organizations may limit women participation
Gender related opportunities	Men and youth stand to benefit with higher profit margins through collective bargaining during marketing
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs are widely discriminated in rural producer organizations VMGs also have limited participation and influence in rural producer organizations Limited access to assets, resources and services, required to join producer groups
VMG related opportunities	<ul style="list-style-type: none"> VMGs stand to benefit with higher profit margins through collective bargaining and marketing Opportunities exist for unemployed youth in production and marketing through ICT
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Institute Director, Horticulture Research Institute P.O Box 220 01000 Thika
Lead organization/scientists	KALRO Scientists- Ndungu B. W., Wambua W., Otipa M. J., Masinde A. O., Muriuki S. J., Ochieng V., Ndambuki, J., Esilaba A.O., Nasirembe W., Mwangi H. W. Ndubi J. and Odhiambo H.O
Partner organizations	MoALFC,

Research gaps

- Efficiency evaluation of the farmer-market linkage models
- Equity distribution among the producers
- Productivity levels among the smallholder farmers due to farmer-market linkage models
- Farmer accessibility to production inputs

2.11.2. Developing a business plan for sweetpotato farming business

TIMP Name	Developing a business plan for sweetpotato farming business
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low management and lack of sustainability and success in sweetpotato farming business due to nature of crop and lack of business plans. Hence no decision making tool on which sweetpotato production model (tuber, seed e.t.c) is based.
What is it? (TIMP description)	A sweetpotato business plan will serve as an internal management and organizing tool that informs decision making; a tool to communicate outside your business; or both

Justification	With a business plan in hand, sweetpotato farmers and rural entrepreneurs will be able to strategically channel resources and make decisions towards creation and/or growth of a successful and sustainable business. It will also help producers assess different production models based on market and hence target their product to market needs
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders and processors
Approaches to be used in dissemination	Trainings, factsheets, manuals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Education levels of the farmers and investors in sweetpotato production • Levels of experience in sweetpotato production • Availability of information on sweetpotato production and marketing • Availability of clean planting material • Market segmentation for various sweetpotato varieties and products (including increased demand for clean vines; livestock feed)
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Users of business plans • County extension staff - Capacity building • NGOs – Capacity building • Private sector (local traders, exporters) – Buyers of sweetpotato • Research institutions – Capacity building • Financial Institutions – Financial support
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Migori county
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and geographically dispersed farmers • Small-scale farming • Inadequate information to stakeholders on sweetpotato production and marketing • Low implementation of available policy and product standards • Low levels of education and skills
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of production clusters • Small-scale farming – aggregation of production to assume large scale-farming • Inadequate information to stakeholders on the sweetpotato production – Developing information hub • Level of policy support – support in extension services • Levels of education – Capacity building
Lessons learnt in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Acceptable by different gender groups in Counties growing sweetpotato • Environmental conditions – Availability of water resources, • Policy conditions – Policy support in opportunities selected; dissemination and
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	The cost of producing sweetpotato include purchase of vines, application of manure and labour costs, which is about KES.51,500 per acre under good management. Basic seed (vines) costs KES.2/vine while pre-basic seed for clean seed multiplication costs KES.20/vine @ 11,000 vines per acre
Estimated returns	<ul style="list-style-type: none"> • Under good management, an acre of land can produce between 7,700 – 11,000 kg of sweetpotatoes and between 20,000 – 25,000 vines • Packaged in 110-kg per bag, the sweetpotato can fetch a price of KES.1,000 per bag, while the vines can be sold at KES.1/vine giving a gross margin per acre of between KES.90,000 – KES.125,000 under good management
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • High illiteracy levels of women leading to lack of record keeping and poor record keeping
Gender related opportunities	<ul style="list-style-type: none"> • Being a high value crop, opportunities exist for youth since they are highly literate and can be able to keep good records
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Some are illiterate hence cannot keep good records
VMG related opportunities	<ul style="list-style-type: none"> • Those youths recovering from drugs and HIVs have an opportunity to venture in this enterprise since they can be able to keep good farm record.

E: Case studies/profiles of success stories

Success stories from previous similar projects	
Application guidelines for users	Training factsheets, manuals and power point slides are available

F: Status of TIMP Readiness (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)

- Ready for upscaling

G: Contacts

Contacts	
Lead organization/scientists	
Partner organizations	<ul style="list-style-type: none"> • MoALFC at the county level • NGOs • FBOs • Public Private sector Partnerships

Research gaps

- Impact of business plan on sweetpotato production
- Adoption of business plan
- Flow of information along the sweetpotato value chain

2.11.3. Collective marketing of sweetpotato - Marketing as a group

TIMP Name	Collective marketing of sweetpotato - Marketing as a group
Category (i.e. technology, innovation or management practice)	Management practice

A: Description of the technology, innovation or management practice

Problem addressed	Individual farmer marketing increases costs and hence inaccessibility to
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	markets due to bulkiness, low volumes, high perishability and hence low prices
What is it? (TIMP description)	Marketing as a group is a collective marketing approach. It involves formation of a group of farmers with an objective of reducing market costs and increasing accessibility.
Justification	Due to small-scale farming of sweetpotato, marketing as a group would enable farmers to gain from economies of scale. The advantages of collective marketing are higher volumes, uniform quality, reliable sellers, reliable buyers, continuous supply, access to distant markets and hence higher price and organization
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Trainings, factsheets, manuals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Production programme outlined • Limited sale of produce outside collective initiative • The farmer is not able to deliver the agreed quality and/or quantity to the group • No side-selling • Favourable weather conditions • Market segmentation for various sweetpotato varieties and products (including increased demand for clean vines; livestock feed)
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Defining production programme • County extension staff - Capacity building • NGOs – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming and production • Inadequate information on sweetpotato production and marketing to stakeholders • Undefined production programmes of sweetpotato and no market segmentation for different sweetpotato varieties/products • Levels of policy support • Fluctuating prices due to seasonal production patterns
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of production clusters • Small-scale farming – aggregation of production to assume large scale-farming • Inadequate information on sweetpotato production and marketing to stakeholders – Developing information hub • Defining production programmes and market segmentation of sweetpotato – SWOT analysis • Level of policy support – support in extension services •
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Commitment: low commitment • Subsistence production: as a source of food

	<ul style="list-style-type: none"> • Volume target: low volume due to side-sales
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Build trust among members; Sufficient volumes for both home consumption and commercialization • Environmental conditions – Favourable condition for sweetpotato production; • Policy conditions – Infrastructural support (inputs, subsidies, marketing price guaranteed systems)
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The cost of producing sweetpotato include purchase of vines, application of manure and labour costs, which is about KES.51,500 per acre under good management. Basic seed (vines) costs KES.2/vine while pre-basic seed for clean seed multiplication costs KES.20/vine @ 11,000 vines per acre. Membership and registration cost for joining the association: KES.1000 (paid once) and KES.500 annual fee
Estimated returns	<ul style="list-style-type: none"> • Under good management, an acre of land can produce between 7,700 – 11,000 kg of sweetpotatoes and between 20,000 – 25,000 vines • Packaged in 110-kg per bag, the sweetpotato can fetch a price of KES.1,000 per bag, while the vines can be sold at KES.1/vine giving a gross margin per acre of between KES.89,000 – KES.124,000 under good management
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Women are widely discriminated in rural producer organizations • Women also have limited participation and influence in rural producer organizations • Socio-cultural norms may limit women’s participation and leadership in groups • Women’s double and triple roles means they may not have time to participate • Women’s status, age, wealth level may influence participation • Limited access to assets, resources and services, required to join producer groups • In some cultures women may not be able to travel away from their homes to producer group meetings, without permission • Strict rules of entry and requirements of producers’ organizations may limit women participation
Gender related opportunities	Men and youth stand to benefit with higher profit margins through collective bargaining during marketing
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs are widely discriminated in rural producer organizations • VMGs also have limited participation and influence in rural producer organizations • Limited access to assets, resources and services, required to join producer groups
VMG related opportunities	<ul style="list-style-type: none"> • VMGs stand to benefit with higher profit margins through collective bargaining and marketing • Opportunities exist for unemployed youth in production and marketing through ICT
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> • None
Application guidelines for users	Training factsheets, manuals and power point slides are available

F: Status of TIMP Readiness (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Institute Director, Horticulture Research Institute P.O Box 220 01000 Thika
Lead organization/scientists	KALRO Scientists- Maina F., Ndungu B. W., Wambua W., Otipa M. J., Masinde A. O., Muriuki S. J., Ochieng V., Ndambuki, J., Esilaba A.O., Nasirembe W., Mwangi H. W. Ndubi J. and Odhiambo H
Partner organizations	<ul style="list-style-type: none"> • Farmers – Defining production programme • County extension staff - Capacity building • NGOs – Capacity building

Research gaps

- Performance of marketing as a group for various sweetpotato produce and products

2.11.4. Profitability analysis – Reviewing performance of sweetpotato agro- enterprise

TIMP Name	Profitability analysis – Reviewing performance of sweetpotato agro- enterprise
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of profitability analysis by farmers, leading to lack of comparison of costs and returns for various sweetpotato models operating scale and therefore performance
What is it? (TIMP description)	Profitability analysis involves recording of costs and returns and therefore determination of profit which indicates the performance of the sweetpotato agro-enterprise
Justification	Profitability analysis reviews the management success and sustainability of the sweetpotato business. It indicates areas of adjustment
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension, NGOs, Researchers.
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Trainings • Factsheets • Manuals • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Record keeping of costs and returns • Ability of farmers to keep and interpret records • Applied and adaptive research to test, validate and release improved sweetpotato varieties • A platform for interaction of stakeholders along the sweetpotato value chain
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – production and record keeping • County extension staff – Facilitators • NGOs – Facilitators • Private sector (local traders and exporters) – Buyers • Research institutions – Facilitators
C: Current situation and future scaling up	
Counties where already	None

promoted if any	
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Inability of farmers to keep records • Inability of farmers to interpret the records kept and translate to decision making • Use of non-costed family labour in sweetpotato production
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Inability of farmers to keep and interpret records – capacity building • Use of non-costed family labour in sweetpotato production – capacity building on how to cost family labour
Lessons learnt in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Awareness on record keeping and interpretation for decision making; • Environmental conditions – suitable for the increased production of sweetpotato • Policy conditions – Policy support in costs of inputs, prices of outputs, implementation of existing standards • Market conditions – Higher prices than costs; economies of scale
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The cost of producing sweetpotato include purchase of vines, application of manure and labour costs, which is about KES.51,500 per acre under good management. Basic seed (vines) costs KES.2/vine while pre-basic seed for clean seed multiplication costs KES.20/vine @ 11,000 vines per acre. Membership and registration cost for joining the association: KES.1000 (paid once) and KES.500 annual fee
Estimated returns	<ul style="list-style-type: none"> • Under good management, an acre of land can produce between 7,700 – 11,000 kg of sweetpotatoes and between 20,000 – 25,000 vines • Packaged in 110-kg per bag, the sweetpotato can fetch a price of KES.1,000 per bag, while the vines can be sold at KES.1/vine giving a gross margin per acre of between KES.89,000 – KES.124,000 under good management
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • High illiteracy levels of women leading to lack of record keeping and poor record keeping
Gender related opportunities	<ul style="list-style-type: none"> • Being a high value crop, opportunities exist for youth since they are highly literate and can be able to keep good records
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Some are illiterate hence cannot keep good records
VMG related opportunities	<ul style="list-style-type: none"> • Those youths recovering from drugs and HIVs have an opportunity to venture in this enterprise since they can be able to keep good farm record.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available

F: Status of TIMP Readiness (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Institute Director, Horticulture Research Institute P.O Box 220 01000 Thika
Lead organization/scientists	KALRO Scientists- Maina F., Ndungu B. W., Wambua W., Otipa M. J., Masinde A. O., Muriuki S. J., Ochieng V., Ndambuki, J., Esilaba A.O., Nasirembe W., Mwangi H. W. Ndubi J. and Odhiambo H.
Partner organizations	MoALFC

2.11.5. Plan for scaling up of sweetpotato agro-enterprise development approach

TIMP Name	Plan for scaling up of sweetpotato agro-enterprise development approach
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Identifying the appropriate method for scaling up of sweetpotato agro-enterprise development. Sweetpotato farmers are often geographically dispersed and with limited production. Options that exist to enable the farmer(s)/farmer groups to scale up their production of sweetpotato would require them to think outside their existing structures bringing to fore other challenges: Can the farmers increase production from increasing size of existing group(s)? Do the farmers need to work with other existing groups? Who will facilitate the new group members
What is it? (TIMP description)	A new plan to organize farmers to supply target markets. This is a plan to increase production through increasing the number of new groups involved in sweetpotato production. The plan involves managing more groups, training other facilitators, working with second-order associations and cooperatives, working with buyers, promoting innovation and communication and the media
Justification	Farmers begin to organize a new plan to season, with higher targets, or more lucrative markets and more farmers involved in production and sales, to target buyers
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Trainings • Factsheets • Manuals • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Ability of farmers to increase production within existing group • Ability to mobilize other members, land and adopt technology in order to increase their production and sales • Can the farmers work with other existing groups (available/not available) • Do the farmers need to form new groups • Market segmentation to enable farmers specialize on varieties for specific markets

	<ul style="list-style-type: none"> • Applied and adaptive research to test, validate and release improved sweetpotato varieties for targeted markets • An innovation platform for interaction among sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Members of producer organization • County extension staff – Capacity building • NGOs – Capacity building • Private sector (local traders and exporters) – Targeted markets • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Dynamics of increasing production from existing group • Issues related to increasing production from expanding size of existing groups
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Dynamics of increasing production from existing group – Linkage to sweetpotato bulking agents with possible short term contracts that would create demand for increased volumes among existing group members and farmers investing in new technology to achieve new targets • Issues related to increasing production from expanding size of existing groups – the first group serve as facilitators to help new farmers develop an enterprise plan; and the new farmers to join the existing groups or form an associated group
Lessons learnt in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – availability of other farmers with existing land who want to join the group • Environmental conditions – would the increase in production come from sustainable use of improved technology, more land, or new members in the group • Policy conditions – Policies supporting formation and functioning of producer organizations • Market conditions – new markets segmented based on sweetpotato variety(ies) of interest
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The cost of producing sweetpotato include purchase of vines, application of manure and labour costs, which is about KES.51,500 per acre under good management. Basic seed (vines) costs KES.2/vine while pre-basic seed for clean seed multiplication costs KES.20/vine @ 11,000 vines per acre. Membership and registration cost for joining the association: KES.1000 (paid once) and KES.500 annual fee
Estimated returns	<ul style="list-style-type: none"> • Under good management, an acre of land can produce between 7,700 – 11,000 kg of sweetpotatoes and between 20,000 – 25,000 vines • Packaged in 110-kg per bag, the sweetpotato can fetch a price of KES.1,000 per bag, while the vines can be sold at KES.1/vine giving a gross margin per acre of between KES.89,000 – KES.124,000 under good management

Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Women are widely discriminated in agro-enterprise groups • Women also have limited participation and influence in agro-enterprise groups • Limited access to assets, resources and services, required to join agro-enterprise groups • In some cultures women may not be able to travel away from their homes to agro-enterprise groups, without permission • Strict rules of entry and requirements of agro-enterprise groups' may limit women participation
Gender related opportunities	<ul style="list-style-type: none"> • Men and youth stand to benefit with higher profit margins through collective bargaining during marketing
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs are widely discriminated in agro-enterprise groups • VMGs also have limited participation and influence in agro-enterprise groups • Limited access to assets, resources and services, required to join agro-enterprise groups
VMG related opportunities	<ul style="list-style-type: none"> • VMGs stand to benefit with higher profit margins through collective bargaining and marketing • Opportunities exist for unemployed youth in production and marketing through ICT
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	Institute Director, Horticulture Research Institute P.O Box 220 01000 Thika
Lead organization/scientists	KALRO Scientists- Maina F., Ndungu B. W., Wambua W., Otipa M. J., Masinde A. O., Muriuki S. J., Ochieng V., Ndambuki, J., Esilaba A.O., Nasirembe W., Mwangi H. W. Ndubi J. and Odhiambo H.
Partner organizations	MoALFC

2.11.6. Internet/online/mobile marketing

TIMP Name	Internet/online/mobile marketing
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Poor market access due to constraints in marketing channels, skills and market information. Consumers are also not aware where to source the products directly from producers
What is it? (TIMP description)	Internet marketing refers to the strategies used to market products and services online and through various digital means. These can include a variety of online platforms, tools, and content delivery systems
Justification	<ul style="list-style-type: none"> • Internet marketing is increasingly becoming crucial tool for agribusinesses. Internet marketing is highly adaptable and can be used

	<p>for a wide range of products. Increased use of internet by consumers to purchase agricultural and non-agricultural products make it an easy channel to share information and create demand for the products at reduced marketing costs.</p> <ul style="list-style-type: none"> • Consumers use a variety of online methods for finding, researching, and eventually making purchasing decisions. Internet marketing reduces costs and hence lowers prices for consumers, and increase price received by producer.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Trainings • Factsheets • Manuals • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Good and reliable internet connection and mobile network coverage • Education levels of the farmers and investors in sweetpotato production and profitability analysis • Availability of information on sweetpotato production and marketing • Sufficient quality and quantity of sweetpotato produce or products to meet targeted demand • A platform for interaction in sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Sweetpotato producers • County extension staff - Capacity building • NGOs – Capacity building • Private sector (local traders and exporters) – Buyers of sweetpotato • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Poor internet connectivity and/or mobile phone network coverage • Low digital skills of farmers • Unconsolidated produce for the market • Distribution of produce/products to distant or scattered consumer markets • Inadequate information to stakeholders on the sweetpotato production and marketing and profitability • Levels of policy support on internet infrastructure
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Internet connectivity – Information hubs to bridge gap in internet connection, network coverage and digital illiteracy • Low digital skills of farmers – capacity building and involvement of youth in online marketing • Unconsolidated produce for the market – Delivery of produce to the designated collection/distribution centers • Distant consumer markets – Contracts with suppliers/transporters • Inadequate information to stakeholders on the sweetpotato production and marketing and profitability - Developing information hubs • Level of policy support – Policy support in internet infrastructure and utilization

Lessons learnt in upscaling if any	<ul style="list-style-type: none"> Requires stakeholders' involvement Remains the best cost effective option for marketing in terms of searching for the market information
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> Social conditions – low levels of adoption of information technology Environmental conditions – improved internet connectivity Policy conditions – Policy supporting information hubs Market conditions – high costs of information technologies
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The cost of producing sweetpotato include purchase of vines, application of manure and labour costs, which is about KES.51,500 per acre under good management. Basic seed (vines) costs KES.2/vine while pre-basic seed for clean seed multiplication costs KES.20/vine @ 11,000 vines per acre. Internet costs could be approximately KES.500 per month (KES.6,000 per season)
Estimated returns	<ul style="list-style-type: none"> Under good management, an acre of land can produce between 7,700 – 11,000 kg of sweetpotatoes and between 20,000 – 25,000 vines Packaged in 110-kg per bag, the sweetpotato can fetch a price of KES.1,000 per bag, while the vines can be sold at KES.1/vine giving a gross margin per acre of between KES.84,000 – KES.116,000 under good management
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> Women have less access to the required tools such as phones and computer than men Women are more illiterate and therefore cannot use the ICTs compared with men
Gender related opportunities	<ul style="list-style-type: none"> Opportunities exist for youth to use the ICT tools since most of them are highly literate and have the phones or the computer
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have less access to the required tools such as phones and computer than men VMGs are more illiterate and therefore cannot use the ICTs compared with men
VMG related opportunities	<ul style="list-style-type: none"> Opportunities exist for youth to use the ICT tools since most of them are highly literate and have the phones or the computer
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, Horticulture Research Institute P.O Box 220 01000 Thika
Lead organization/scientists	KALRO Scientists- Maina F., Ndungu B. W., Wambua W., Otipa M. J., Masinde A. O., Muriuki S. J., Ochieng V., Ndambuki, J., Esilaba A.O., Nasirembe W., Mwangi H. W. Ndubi J. and Odhiambo H.
Partner organizations	MoALFC

2.11.7. Contracted farming model in sweetpotato production

TIMP Name	Contracted farming model in sweetpotato production
Category (i.e. technology,	Management practice

innovation or management practice)	
A: Description of the technology, innovation or management practice	
Problem addressed	Limited access to market for specific sweetpotato produce and products and market failure has led to low adoption of TIMPs, low production/productivity, limited area under sweetpotato production, poor quality produce and subsequently low market price for the producers
What is it? (TIMP description)	Contract farming involves private companies getting into a formal or informal agreement, and extending lines of credit to producers in the form of farming inputs and technical assistance. Under contract farming terms, contractors commit themselves to buy the entire produce/product at an agreed price. On the other hand, producers avail desired produce in agreed quality and quantity for sale.
Justification	Without contract farming in sweetpotato production, smallholder farmers have no incentive to increase production and hence realize low prices for their produce. Contract farming is a contractual arrangement between producers and buyers of a farm product. The contract can either be formal or informal (oral or written), and will specify one or more conditions of production and marketing of an agricultural product. In essence, contract farming commits the farmer to produce a certain (quality and quantity of) commodity at a certain time for an agreed price and, in return, the contractor undertakes to buy the commodity, and may provide agricultural extension and other services to producers in order to satisfy production requirements in terms of quality and quantity. The benefits of contract farming to farmers are improved market access, increased incomes, reduction in the risk of price fluctuations, credit and financial intermediation, timely provision of inputs, monitoring and labour incentives, reduction of production risk, introduction of higher-value crops, improved collective bargaining, household spill-over benefits and improved access to extension. A written contract farming is recommended.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Traders • Extension • Research institutions • Farmer cooperative societies
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Barazas • Trainings • Factsheets • Manuals • Media • Farmer field and business Schools(FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Willing farmers with available land and sufficient production volume • Availability of traders • Market segregation that increases demand for specific sweetpotato produce (seed, tubers, fodder and processed products) • Enforcement of and bidding contract farming • Applied and adaptive research to test, validate improve sweetpotato

	<p>TIMPs</p> <ul style="list-style-type: none"> • A platform for interaction of stakeholders along the sweetpotato value chain
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Contract party and beneficiaries • County extension staff - Capacity building, witness the signing and administration of contract • NGOs – Capacity building • Private sector (local traders and exporters) – Contract party and beneficiaries • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming hence limited volumes for contract farming • Lack of trust in contract farming by producers • Level of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of production clusters • Small-scale farming – Increase volume through increase in productivity and establishment of collection points • Lack of trust – MoALFC as witnesses outside the contract to ensure adherence to set contract by both producers and marketers • Level of policy support – County policy formulation and enforcement for contract farming
Lessons learnt in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Conflicts with traditional farming • Environmental conditions – adherence to planting guidelines reduces pest incidences in the production region; sweetpotato provide good cover crop hence reduced erosion once well-established management • Policy conditions – Policy in formulation and enforcement • Market conditions – volume, place, price, promotion, traders
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Women have less access to knowledge and information on contract farming than men • Women have less access to land for farming than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth to enter into contract farming through renting of land for farming for increased profit margins
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to knowledge and information on contract farming than men • VMGs have less access to land for farming than men
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth to enter into contract farming through renting of land for farming for increased profit margins
E: Case studies/profiles of success stories	

Success stories from previous similar projects	None	
Application guidelines for users	Training factsheets, manuals and power point slides	
F: Status of TIMP Readiness (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	The guidelines for the contract farming are ready for upscaling
G: Contacts		
Contacts	Institute Director, Horticulture Research Institute P.O Box 220 01000 Thika	
Lead organization/scientists	KALRO Scientists- Maina F., Ndungu B. W., Wambua W., Otipa M. J., Masinde A. O., Muriuki S. J., Ochieng V., Ndambuki, J., Esilaba A.O., Nasirembe W., Mwangi H. W. Ndubi J. and Odhiambo H.	
Partner organizations	MoALFC	

Gaps for further research

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

2.11.8. Entrepreneurship model for sweetpotato marketing

TIMP Name	Entrepreneurship model for sweetpotato marketing
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Farmers' failure to apply entrepreneurship while producing and marketing sweetpotato leading to low prices
What is it? (TIMP description)	An entrepreneur farmer undertakes innovations and finance and business acumen in an effort to transform innovations into economic goods that meet targeted need in society and ultimately profit and sustainability.
Justification	Farmers become entrepreneurs when business principles are applied in farming practices to make businesses successful. Production should be based on meeting a need in the market, for demand, profitability and sustainability to be assured. Failure to apply business principles farming business would not be successful.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension • NGOs • Researchers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Trainings • Factsheets • Manuals • Market visits • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Organization of farmers • Availability of innovations • Achievement of profit • Access to finance

	<ul style="list-style-type: none"> • Availability of facilitators • Availability of many traders • Ability of farmers to meet demanded quantity and quality consistently • Economies of scale and comparative advantage in production and marketing of sweetpotato • Applied and adaptive research to test, validate and release improved sweetpotato varieties • A platform for interaction in sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Acceptability of innovations • County extension staff - Facilitators • NGOs – Facilitators • Private sector (local traders and exporters) – Buyers • Research institutions – Facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Small-scale production of sweetpotato • Availability of information • Profitability in sweetpotato production and marketing • Levels of policy support
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Small-scale farming – capacity building to farmers • Availability of information on innovations • Profitable innovations • Strengthening county policy support
Lessons learnt in upscaling if any	<ul style="list-style-type: none"> • Reduced cost of production, increased profit
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Conflicts with traditional production methods and perceptions • Environmental conditions – Use of pesticides and disposal • Market conditions – Contract farming, access to inputs such as fertilizer
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The cost of producing sweetpotato include purchase of vines, application of manure and labour costs, which is about KES.51,500 per acre under good management. Basic seed (vines) costs KES.2/vine while pre-basic seed for clean seed multiplication costs KES.20/vine @ 11,000 vines per acre. Membership and registration cost for joining the association: KES.1000 (paid once) and KES.500 annual fee
Estimated returns	<ul style="list-style-type: none"> • Under good management, an acre of land can produce between 7,700 – 11,000 kg of sweetpotatoes and between 20,000 – 25,000 vines • Packaged in 110-kg per bag, the sweetpotato can fetch a price of KES.1,000 per bag, while the vines can be sold at KES.1/vine giving a gross margin per acre of between KES.89,000 – KES.124,000 under good management
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Women lack entrepreneurial skills and capacity to engage in entrepreneurship compared with men • Women lack basic reading and numeracy skills so they can run their businesses compared with men

	<ul style="list-style-type: none"> • Women do not know how to save their money that can be used in entrepreneurship compared with men • Women do not usually apply for loans that can be used to manage their businesses and increase their profits due to lack of collateral compared with men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for women to venture in entrepreneurship if they learn how to save their money, apply for loans
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs lack basic reading and numeracy skills so they can run their businesses compared with men • VMGs lack the business acumen compared with men • VMGs lack the starting capital
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs to venture in entrepreneurship through affirmative action funds that are given to them e.g. Uwesofund etc.

E: Case studies/profiles of success stories

Success stories from previous similar projects	Increased income and diversification in investments
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Available innovations are ready for upscaling

G: Contacts

Contacts	Maina F and Gichangi A
Lead organization/scientists	KALRO-HQ and KALRO-Njoro
Partner organizations	MoALFC

Research Gaps

- Sustainability based on market prices
- Innovations for the increased productivity

2.11.9. Agricultural Policy options

TIMP Name	National Agricultural policy framework for smallholder sweetpotato producers
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Smallholder farmers' agency has been largely neglected in the agricultural policy making process in Kenya. The smallholder farmers are framed as having no innovations or insights to offer, and generally only receivers. Indeed, they are considered to have little agency beyond the adoption of modernizing innovations that are believed to transform agriculture and build livelihoods.
What is it? (TIMP description)	National Agricultural policy framework includes policies that are framed to benefit smallholder farmers among others, providing policy objectives and instruments.
Justification	A delink exists between the smallholder farmers' perspectives and knowledge and the agricultural policy making process in Kenya. The process overlooks diverse agricultural transformation pathways that are sustainable in local social/material conditions and based on smallholder

	farmers' knowledge. This in turn means that the stated policy objectives of poverty reduction by building smallholder livelihoods and increasing agricultural productivity, remain unmet. We consider the pathways through which smallholder farmers' perspectives and knowledge can be included in policy going forward
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Policy makers • Traders • Processing industries • Extension • NGOs • Research institutions
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings • Radio • Television • Social media (WhatsApp, Facebook, twitter) • Internet • Farmers' groups • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong stakeholder institutions along the sweetpotato value chain including producer organization • Producer awareness and interest in the policy making process • Applied and adaptive research to test, validate and improve sweetpotato technologies, innovations and management practices • A functional innovation platform for stakeholder interaction along sweetpotato value chain
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Aware and demanding sweetpotato policies and standards to support production and marketing • County extension staff and NGOs – Sensitization and capacity building of farmers • Private sector (local traders and exporters) – Demanding sweetpotato policies to support production and marketing • Research institutions – Sensitization of stakeholders • Policy makers – Assist in policy making
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination	<ul style="list-style-type: none"> • Value Chain: Sweetpotato is bulky and highly perishable and mainly produced in small scale for local market coupled with low yield. This means smallscale farmers who adopt the TIMPs to improve production and productivity, may still not be able to influence the decision making process along the value chain due to low individual volumes; in essence making them price receivers • Standards: Existing standards at the production level may not be known by most of the sweetpotato producers and hence not widely adopted. This is further complicated by the low volumes produced and lack of aggregation

	<ul style="list-style-type: none"> • Aggregation: Aggregation models hardly exist in sweetpotato production. Farmers are often not receptive due to previous bad experiences in other value chains that led to lack of trust. These weak organizations provide few services to farmers and subsequently limited bargaining power. • Financial Incentives: Sweetpotato production was in most regions done for subsistence with excess sold. There is hence limited financial support to and demand from sweetpotato producers. Financial services that would help producers shift from dependence on rainfed sweetpotato production to irrigation, hence ensuring continuous supply, would require investment in infrastructure (irrigation, mechanization) and access to bulk clean planting material. Meanwhile the bulk of financial incentives, including tax breaks, exemption from import duties, and subsidized electricity are often targeted towards apparel manufacturers downstream in the value chain including those involved in processing sweetpotato products. Some private companies may invest backward in their supply chains to increase farmer production by entering purchase contracts, which may be hindered by rainfed production hence seasonal availability. However, often, none of these efforts are explicitly tied to environmental or CSA standards.
<p>Suggestions for addressing the challenges</p>	<p>Value Chain: Enhance productivity, aggregation of produce and total production for specific markets through better access to clean and improved sweetpotato planting materials/varieties, irrigation for large scale production, and CSA management practices. Develop targeted incentives to encourage stronger engagement of producers by downstream actors.</p> <p>Standards: Existing sweetpotato produce and products standards and classifications be available to producers and should align with Kenya’s climate-smart agriculture strategy, through coordination of relevant institutions across the sector. Public support to farmer groups/associations to promote and enable higher quality production through market linkages, access to clean planting material and CSA extension training.</p> <p>Aggregation: Establishment of formalized farmer associations/cooperatives targeting sweetpotato production and warehousing (including cold storage for distant markets) can strengthen market linkages, set guaranteed prices for farmers, and enable access to resilient, high-yielding seeds and other climate-smart inputs. This should be coupled with increased capacity building on group dynamics for sustainable farmer organization</p> <p>Financial Incentives: Financial incentives can be designed to incentivize private sector, downstream value chain actors to provide services to producers, including contractual agreements, access to irrigation and mechanization specific for sweetpotato production, conditional subsidies. The government policy on improving consumer nutritional value by enhancing dietary diversity provides opportunity for improved sweetpotato varieties that are of high nutritional value. Integrating the nutritional value standards in the requirements for millers as well would create increased demand for high quantity of quality sweetpotato production</p>

Lessons learnt in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Traditional farming of sweetpotato including use of varieties of low productivity and nutritional value • Environmental conditions – Plant in areas not prone to weevil infestation. As a good cover crop, sweetpotato is well adapted to both high and low rainfall areas • Policy conditions – Implementation of existing policies and standards relating to sweetpotato production and marketing • Market conditions – Improved market infrastructure and linkages to distant markets; high volumes to benefit from economies of scale
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The cost of producing sweetpotato include purchase of vines, application of manure and labour costs, which is about KES.51,500 per acre under good management. Basic seed (vines) costs KES.2/vine while pre-basic seed for clean seed multiplication costs KES.20/vine @ 11,000 vines per acre. Membership and registration cost for joining the association: KES.1000 (paid once) and KES.500 annual fee
Estimated returns	<ul style="list-style-type: none"> • Under good management, an acre of land can produce between 7,700 – 11,000 kg of sweetpotatoes and between 20,000 – 25,000 vines • Packaged in 110-kg per bag, the sweetpotato can fetch a price of KES.1,000 per bag, while the vines can be sold at KES.1/vine giving a gross margin per acre of between KES.89,000 – KES.124,000 under good management
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate youth representation in the policy formulation and validation process if they focus and strategize well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels of policy formulation since there are policy frameworks to support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	Training factsheets, manuals and power point slides
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	
	Requires validation and upscaling
G: Contacts	
Contacts	Institute Director, Horticulture Research Institute, P.O Box 220 01000 Thika
Lead organization/scientists	KALRO Scientists- Maina F., Ndungu B. W., Wambua W., Otipa M. J., Masinde A. O., Muriuki S. J., Ochieng V., Ndambuki, J., Esilaba A.O., Nasirembe W., Mwangi H. W. Ndubi J. and Odhiambo H.O

Partner organizations	MoALFC
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Gaps for further research

- Impact of implementation of sweetpotato-related policies and standards on market demand
- Equity distribution among the stakeholders
- Productivity levels among the smallholder farmers of sweetpotato
- Farmer accessibility to production inputs
- Impact on sweetpotato prices

2.11.10. Policy options and objectives related to sweetpotato farming

TIMP Name	Policy options and objectives related to sweetpotato farming
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Market failure in influencing the behavior in sweetpotato production and marketing
What is it? (TIMP description)	Implementation of the institutional framework for roots and tuber crops. A policy towards the agricultural sector as a whole or specific to roots and tuber crops sub-sector or specifically for sweetpotato can be characterized as consisting of three sets of elements; objectives, instruments of policy and rules for operating instruments of policy.
Justification	Agricultural policies for supporting sweetpotato output are based at farm, market and ward levels. The policy objective is to increase sweetpotato output and linkages along the value chain. The policy instruments chosen might raise the price of sweetpotato received by producers, and encourages commercial production of tubers, seed multiplication and/or sweetpotato products..
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Traders • Sweetpotato processing industries • Extension • NGOs • Research institutions • Policy makers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings • Radio • Television • Social media (WhatsApp, Facebook, twitter), internet • Farmers' groups • Farmer field and business schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Functional sweetpotato stakeholders innovation platform • Availability of resources to implement the roots and tubers policy, specifically for sweetpotato value chain • Specific policy objective statement • Applied and adaptive research to test, validate and improve sweetpotato TIMPs
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Understanding and demanding sweetpotato policies to support production and marketing

	<ul style="list-style-type: none"> • Private and public extension service agents - Sensitization of farmers • NGOs – Sensitization of farmers • Private sector (local traders and exporters) – Understanding and demanding sweetpotato policies to support production and marketing • Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Weak and disjointed value chain leadership structures • Weak linkages between partner organizations and the legal framework governing sweetpotato (leading to duplication of efforts and neglect of others) • Weak data and management information systems characterized with unreliable data to support/guide decision making • Inadequate information to stakeholders on the existing policies (national or county level) related to sweetpotato production and marketing
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organizations as an institution with representation of various gender including VMGs • Weak leadership structures and linkages along the value chain – establish and support sweetpotato innovation platforms • Weak data and management information systems – • Inadequate information to stakeholders on the existing agricultural policies – Sensitization of stakeholders
Lessons learnt in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Acceptability of the policies • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Limited implementation of existing sweetpotato policies and standards • Market conditions - Poor market infrastructure
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate youth representation in the policy formulation and validation process if they focus and strategize well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels of policy formulation since there are policy frameworks to support their participation

E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Requires validation
G: Contacts	
Contacts	KALRO-HQ and KALRO Njoro
Lead organization/scientists	Maina F. and Gichangi A.
Partner organizations	MoALFC

GAPS

- Adoption of policy options
- Understanding of the root and tuber national framework in the context of target county
- Equity distribution among the stakeholders
- Productivity levels among the smallholder farmers
- Farmer accessibility to production inputs

2.11.11. Instruments of policy related to sweetpotato

2.12.3 TIMP Name	Instruments of policy related to sweetpotato
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Failure to achieve policy objectives due lack of instruments related to smallholder farmers' agency
What is it? (TIMP description)	Policy instruments are the means to achieve policy objectives
Justification	Methods of attempting to achieve policy objectives may take a wide variety forms. It is very likely that a particular policy instrument, although designed have primarily an efficiency, distributive, or stability effect, will also have some impact on the other objectives
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Traders • Processing industries • Extension • NGOs • Research institutions • Policy makers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings • Radio • Television • Social media (What's App, Facebook, twitter) • Internet • Farmers' groups • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of policy objectives • Availability of policy instruments • Applied and adaptive research to test, validate and improve sweetpotato

	<p>TIMPs</p> <ul style="list-style-type: none"> • A functional innovation platform for interaction by sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – beneficiaries of policy instruments • County extension staff - Sensitization of farmers • NGOs – Sensitization of farmers • Private sector (local traders and exporters) – beneficiaries • Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Smallscale production of sweetpotato, limiting producers involvement in the decision making process • Inadequate information to stakeholders on the national and county agricultural policies relevant to sweetpotato • Weak linkages of stakeholders and institutions along the sweetpotato value chain and the legal framework • Sweetpotato production has continued over the years with limited policy intervention, which may slow down process towards developing instruments for implementation of policies
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Small-scale farming – Formation of producer and marketing groups whose representatives are intentionally involved in the decision making process • Inadequate information to stakeholders on the relevant national and county agricultural policies – Sensitization of stakeholders and establishment of innovation platforms • Weak linkages of stakeholders and institutions – Support establishment and functioning of sweetpotato innovation platform from relevant county • Slow implementation process due to fixed mindset – Intentionally develop action plans within innovation platforms
Lessons learned in up scaling if any	None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Low understanding of policy instruments • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Limited implementation of existing sweetpotato-related policies and standards • Market conditions – Poor market infrastructure
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	
Estimated returns	
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate youth representation in the policy formulation and validation process if they focus and strategize well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process

VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels of policy formulation since there are policy frameworks to support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	KALRO-HQ and KALRO Njoro
Lead organization/scientists	Maina F. and Gichangi A.
Partner organizations	MoALFC

GAPS

- Validation of policy instruments
- Equity distribution among the stakeholders
- Farmer accessibility to production inputs markets
- Farmers accessibility to output markets

2.11.12. Climate-smart sensitive policy cycle for and implementation of smallholders' issues

TIMP Name	Climate-smart sensitive policy cycle for and implementation of smallholders' issues
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Why is a policy cycle an appropriate tool for making policies related to sweetpotato? Policy cycle is a valuable device for new policy development. It is a tool which divides complex procedures into convenient and manageable steps. These individual steps provides a framework and antedates any forthcoming issues related to policy development
What is it? (TIMP description)	The climate-smart sensitive policy cycle is usually divided into five stages: agenda setting, formulation, assessment of climate-smart implications, implementation, and evaluation
Justification	The climate-sensitive cycle creates the need for policy formulation based on the agricultural problem emergence/issues. The policy cycle is an idealized process that explains how policy should be drafted, implemented and assessed. It serves more as an instructive guide for those new to policy than as a practical strictly-defined process, but many organizations aim to complete policies using the policy cycle as an optimal model. Policy cycle is a valuable tool for new policy development, which divides complex procedures into convenient and manageable steps. These flexible steps ensure that the type of intervention, requirements for sustainable implementation (including resources); arising externalities; feedback loop and scale of impact are spelt out to ensure successful and sustainable implementation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Traders

	<ul style="list-style-type: none"> • Processing industries • Extension • NGOs • Research institutions
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings • Radio • Television • Social media (What's App, Facebook, twitter) • Internet • Farmers' groups • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) for sweetpotato
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Understanding of impact of the policy making process on sweetpotato production, processing, marketing and utilization • The stages of problem emergence, formulation, implementation and evaluation • Applied and adaptive research to test, validate and improve sweetpotato TIMPs • A platform for interaction in sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – generate issues • County extension staff - capacity building • NGOs – capacity building • Private sector (local traders and exporters) – generate issues • Research institutions – capacity building • Policy makers
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Understanding of the different stages of the climate-smart sensitive policy making process • Small-scale farming hence limited need to be involved in the policy making process • Inadequate information to stakeholders on policy related issues • Lack of budgetary and other resource support for implementation
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Understanding the process by various stakeholders – sensitization/capacity building and involvement of stakeholders in the process • Small-scale farming – group formation and involvement of influential group members in process with feedback to producers • Inadequate information to stakeholders – Sensitization on the roles of each policy cycle stages • Lack of resource support for the process – Participatory development of sweetpotato levy to facilitate process
Lessons learnt in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Non-involvement of producers in policy processes • Environmental conditions – environmental issues • Policy conditions – Lack of financing and support of policy making process

	• Market conditions – Market issues
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
Gender related opportunities	• Opportunities exist for adequate youth representation in the policy formulation and validation process if they focus and strategize well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
VMG related opportunities	• Opportunities exist for VMGs participation in all levels of policy formulation since there are policy frameworks to support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	KALRO-HQ and KALRO Njoro
Lead organization/scientists	Maina F. and Gichangi A.
Partner organizations	MoALFC

Research Gaps

- Analysis of policy model
- Impact on the new policy on sweetpotato production and marketing

2.11.13. Policy validation cycle for policy customization

TIMP Name	Policy validation cycle for policy customization
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	High costs in making a new policy(ies) relevant to sweetpotato production, processing and marketing
What is it? (TIMP description)	A policy validation cycle involves an existing agricultural policy, database and stakeholders.
Justification	To reduce costs in developing a new policy, policy validation cycle is useful.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, traders • Processing industries • Extension • NGOs

	<ul style="list-style-type: none"> • Research institutions
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings • Radio • Television • Social media (What's App, Facebook, twitter) • Internet • Farmers' groups • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability and willingness of knowledgeable stakeholders • Availability of agricultural policies • Applied and adaptive research to test, validate and improve sweetpotato TIMPs • A platform for interaction in sweetpotato value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – provide database • County extension staff - data collection • NGOs – provide data • Private sector (local traders and exporters) – provide data • Research institutions – analysis and recommendations
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Migori
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Limited funding for validation • Weak linkages and information management along sweetpotato value chain • Small-scale farming hence scattered information • Poorly established sweetpotato value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Limited funding – participatory process to ensure validation process receives funding • Weak linkages – establish and support sweetpotato innovation platforms • Poorly established sweetpotato value chain – strengthening sweetpotato value chain through functional innovation platform
Lessons learnt in upscaling if any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – lack of information • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Lack of financing for implementation process • Market conditions – lack of information
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate youth representation in the policy formulation and validation process if they focus and strategize well
VMG issues and concerns in	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development

development and dissemination, adoption and scaling up	forums at all levels • Inadequate representation of youth and women in the policy of validation process
VMG related opportunities	• Opportunities exist for VMGs participation in all levels of policy formulation since there are policy frame to support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	
	Requires validation
G: Contacts	
Contacts	KALRO-HQ and KALRO Njoro
Lead organization/scientists	Maina F. and Gichangi A.
Partner organizations	MoALFC

Research Gaps

- Impact of validated policies

2.12 AGRICULTURAL POLICY OPTIONS

2.12.1. National Agricultural policy framework for smallholder sweetpotato producers

TIMP Name	National Agricultural policy framework for smallholder sweetpotato producers
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Smallholder farmers' agency has been largely neglected in the agricultural policy making process in Kenya. The smallholder farmers are framed as having no innovations or insights to offer, and generally only receivers. Indeed, they are considered to have little agency beyond the adoption of modernizing innovations that are believed to transform agriculture and build livelihoods.
What is it? (TIMP description)	National Agricultural policy framework includes policies that are framed to benefit smallholder farmers among others, providing policy objectives and instruments.
Justification	A delink exists between the smallholder farmers' perspectives and knowledge and the agricultural policy making process in Kenya. The process overlooks diverse agricultural transformation pathways that are sustainable in local social/material conditions and based on smallholder farmers' knowledge. This in turn means that the stated policy objectives of poverty reduction by building smallholder livelihoods and increasing agricultural productivity, remain unmet. We consider the pathways through which smallholder farmers' perspectives and knowledge can be included in policy going forward
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Policy makers

	<ul style="list-style-type: none"> • Traders • Processing industries • Extension • NGOs • Research institutions
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings • Radio • Television • Social media (WhatsApp, Facebook, twitter) • Internet • Farmers' groups • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of stakeholders • Producer awareness and interest in the policy making process • Availability of specific sweetpotato-based policies • Applied and adaptive research to test, validate and release improved sweetpotato varieties • A platform for stakeholder interaction along sweetpotato value chain
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Aware and demanding sweetpotato policies to support production and marketing • County extension staff – Sensitization of farmers • NGOs – Sensitization of farmers • Private sector (local traders and exporters) – Demanding sweetpotato policies to support production and marketing • Research institutions – Sensitization of stakeholders • Policy makers – Assist in policy making
C: Current situation and future scaling up	
Counties where already promoted if any	
Counties where TIMPs will be up scaled	Migori

<p>Challenges in development and dissemination</p>	<p>Value Chain: Sweetpotato is bulky and highly perishable and produced in small scale coupled with low yield. This means farmers are price receivers and not influential in the decision making process</p> <p>Standards: Existing standards at the production level may not be known by most of the sweetpotato producers and hence not widely adopted. This is further complicated by the low volumes produced and lack of aggregation</p> <p>Aggregation: Aggregation models hardly exist in sweetpotato production. Farmers are often not receptive due to previous bad experiences in other value chains that led to lack of trust. These weak organizations provide few services to farmers while providing limited bargaining power.</p> <p>Financial Incentives: Sweetpotato production was for a long term for subsistence with excess sold. There is hence limited financial support to and demand from sweetpotato producers through subsidized seed and irrigation infrastructure for large scale production. Meanwhile the bulk of financial incentives, including tax breaks, exemption from import duties, and subsidized electricity are often targeted towards apparel manufacturers downstream in the value chain including those involved in processing sweetpotato products. Some private companies may invest backward in their supply chains to increase farmer production by entering purchase contracts, which may be hindered by rainfed production hence seasonal availability. However, none of these efforts are explicitly tied to environmental or CSA standards.</p>
<p>Suggestions for addressing the challenges</p>	<p>Value Chain: Enhance productivity and total production for specific markets through better access to clean and improved sweetpotato planting materials/varieties, irrigation for large scale production, and CSA management practices. Develop targeted incentives to encourage stronger engagement of producers by downstream actors.</p> <p>Standards: Existing sweetpotato produce and products standards and classifications should align with Kenya’s climate-smart agriculture strategy, in coordination with relevant institutions across the sector; and be available to producers. Farmer groups/associations should receive public support to promote and enable higher quality production through market linkages, access to clean planting material and CSA extension training.</p> <p>Aggregation: Establishment of farmer associations/cooperatives targeting sweetpotato production and warehousing (including cold storage to distant markets) can strengthen market linkages, set guaranteed prices for farmers, and enable access to resilient, high-yielding seeds and other climate-smart inputs.</p> <p>Financial Incentives: Financial incentives can be designed to incentivize private sector, downstream value chain actors to provide services to producers, for example through conditional subsidies. The government policy on improving consumers nutritional value by enhancing dietary diversity provides opportunity for improved sweetpotato varieties that are of high nutritional value. Integrated in the requirements for millers as well would create increased demand for high quality and quantity sweetpotato production</p>
<p>Lessons learnt in upscaling if</p>	<p>None</p>

any	
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Traditional farming of sweetpotato including use of varieties of low productivity and nutritional value • Environmental conditions – Plant in areas not prone to weevil infestation. As a good cover crop, sweetpotato is well adapted to both high and low rainfall areas • Policy conditions – Implementation of existing policies and standards relating to sweetpotato production and marketing • Market conditions – Improved market infrastructure and linkages to distant markets; high volumes to benefit from economies of scale
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The cost of producing sweetpotato include purchase of vines, application of manure and labour costs, which is about KES.51,500 per acre under good management. Basic seed (vines) costs KES.2/vine while pre-basic seed for clean seed multiplication costs KES.20/vine @ 11,000 vines per acre. Membership and registration cost for joining the association: KES.1000 (paid once) and KES.500 annual fee
Estimated returns	<ul style="list-style-type: none"> • Under good management, an acre of land can produce between 7,700 – 11,000 kg of sweetpotatoes and between 20,000 – 25,000 vines • Packaged in 110-kg per bag, the sweetpotato can fetch a price of KES.1,000 per bag, while the vines can be sold at KES.1/vine giving a gross margin per acre of between KES.89,000 – KES.124,000 under good management
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for adequate youth representation in the policy formulation and validation process if they focus and strategize well
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Inadequate representation of youth and women in policy development forums at all levels • Inadequate representation of youth and women in the policy of validation process
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs participation in all levels of policy formulation since there are policy frameworks to support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides
F: Status of TIMP Readiness (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	
	Requires validation and upscaling
G: Contacts	
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Lead organization/scientists	Maina F. and Gichangi A.
Partner organizations	MoALFC

Research Gaps

- Adoption of policies
- Equity distribution among the stakeholders

- Productivity levels among the smallholder farmers of sweetpotato
- Farmer accessibility to production inputs
- Impact on sweetpotato prices



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