



Kenya Climate Smart
Agriculture Project

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



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DISCLAIMER

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

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FOREWORD

Kenya Climate-Smart Agriculture Project (KCSAP) tasked the Kenya Agricultural and Livestock Research Organization (KALRO) with the implementation of the project's Component 2 on 'Strengthening Climate-Smart Agricultural Research and Seed Systems. The component activities are geared towards developing, validating, adopting and delivering context-specific Climate-smart Agriculture (CSA) technologies, innovation and management practices (TIMPs). The other responsibility is the development of sustainable seed production and distribution systems for priority value chains to enhance availability and access to improved seeds, animal breeds and fingerlings by target beneficiaries. This will be supported under Component 1 which aims at upscaling climate-smart agricultural practices. Against this background, KALRO and her NARS partners have developed, validated and availed CSA TIMPs for dissemination and adoption. The TIMPs have further been unpacked during the development of Training of Trainers (ToT) Manuals for use in training public and private extension service providers and lead farmers. The ToT Manuals are instructional guides to be used for teaching and learning step-by-step CSA innovations for each of the 24 value chains being addressed. The training content is drawn from the CSA TIMPs that support respective value chains.

Extensive information from research and background data drawn from the TIMPs are used to develop the contents of TOT Manuals and are arranged in progressive modules. Their relevance is based on the needs teased out of the value chains and the project objectives. The training design takes into consideration the delivery system, the partners and their roles, the duration of the training and the logical flow of the sessions. Similar content requiring similar delivery systems is grouped while the roles of the partners are tapped in the training and planning of the training sessions. The training modules have a uniform outline that ensures every aspect of the TIMPs is 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 to learn by participating in the actual field activities. Furthermore, to ensure that the training across various groups is standardized, trainers' guidelines, detailed descriptions of the trainees, program, training methods and a training evaluation have been provided in the manual. Adhering to these guidelines, therefore, enables the possibility of replicating the training in several locations without loss of details regardless of whether conducted by different trainers.

The use of this TIMPs inventory is expected to contribute to the achievement of the envisaged 'Triple Wins' of increased productivity, enhanced resilience and reduction of greenhouse gas emissions. It is highly advised that the inventory of TIMPs be used in conjunction with the respective ToT Manuals for value chains.

I am greatly indebted to the value chain leaders and all those who participated in the preparation of this inventory, which is expected to herald a new way of delivering training content in a changing agricultural environment.

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

PREFACE

The Kenya Climate-Smart Agriculture Project (KCSAP) is a Government of Kenya project with support from both the World Bank and the government. The project runs for five years and implemented in 24 counties, mainly in the arid and semi-arid lands (ASALs), at an approximate cost of KES 25 billion. The project development objective (PDO) is “to increase agricultural productivity and build resilience to climate change risks in the targeted smallholder farming and pastoral communities, and in the event of an Eligible Crisis or Emergency, to provide an immediate and effective response.” This objective is to be achieved through the implementation of five key components, which are 1) Upscaling Climate-Smart Agricultural Practices, 2) Strengthening Climate-Smart Agricultural Research and Seed Systems, 3) Supporting Agro-weather, Market, Climate, and Advisory Services, 4) Project Coordination and Management and 5) Contingency Emergency Response.

Component 1 involves facilitating the empowering of farmers and communities to adopt technologies, innovations and management practices (TIMPs) to achieve the Climate Smart Agriculture (CSA) triple-wins of; increased productivity, enhanced resilience (adaptation), and reduced Greenhouse gas (GHG) emissions (mitigation). Component 2 is tasked with the responsibility of providing the TIMPs. Therefore, it supports the development, validation, and adoption of context-specific CSA TIMPs to target beneficiaries under Components 1 and 3 as well as the development of sustainable seed production and distribution systems.

To catalyze the uptake of TIMPs, 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 for the prioritized value chains. The crop-based value chains are 19 and include roots and tubers (cassava, potato), pulses (dry beans, green gram and pigeon peas), vegetables (tomato, onion, indigenous vegetables, kale and cabbages), cereals (sorghum, millet, maize, teff) nuts (cashew nut), fruits (banana, mango, watermelon) and fibre (cotton). Those that are animal production based are five (5) and include apiculture, indigenous chicken (meat and eggs), dairy (cattle and camel), red meat (cattle, sheep and goats) and aquaculture. Also, there are three (3) cross-cutting themes on pastures and fodder, natural resource management, and animal health. The TIMPs have been categorized into those ready for upscaling and those requiring validation. Furthermore, Research Gaps that required further research and development of TIMPs have been identified. Training of Trainers (ToT) manuals focusing on TIMPs that are ready for upscaling for each of the value chains have been subsequently developed to form the basis of training county extension staff, service providers and lead farmers. Those trained are in turn expected to cascade the training to beneficiaries in the targeted smallholder farming, agro-pastoral and pastoral communities in the 24 project counties of Marsabit, Isiolo, Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.

KALRO having the mandate of implementing the activities under Component 2 has been instrumental in using its information resources and those of partners and collaborators to come up with the inventories of TIMPs and corresponding ToT Manuals. The use of these information resources coupled with the accompanying training and the contribution of the other project components will go a long way in enabling the KCSAP to meet its development objective.

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

Francis Muthami

National Project Coordinator

Kenya Climate-Smart Agriculture Project

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LIST OF ABBREVIATIONS AND ACRONYMS

AEZs	Agro-ecological zones
AIP	Agricultural Innovation Platforms
ASALs	Arid and Semi-Arid Lands
ASD	Anaerobic Soil Disinfection
CA	Conservation Agriculture
CBO	Community Based Organization
CIG	Common Interest Group
CSA	Climate Smart Agriculture
CoG	Council of Governors
FFS	Farmer Field School
FFBS	Farmer Field and Business School
FSMS	Food Safety Management System
GAPS	Good Agricultural Practices
ha	Hectare
HACCP	Hazard Analysis Critical Control Points
HCD	Horticulture Crop Directorate
HQ	Headquarters
GeRRI	Genetic Resources Research Institute
GHG	Green House Gases
ICM	Integrated Crop Management
ICT	Information Communications Technology
IDM	Integrated Disease Management
IMM	Integrated Manure Management
IPM	Integrated Pest Management
ISFM	Integrated Soil Fertility management
IWM	Integrated Weed Management
KEPHIS	Kenya Plant Health Inspectorate Service
KALRO	Kenya Agricultural and Livestock Research Organization
KCSAP	Kenya Climate Smart Agriculture Project
kg	Kilogram
MoALFC	Ministry of Agriculture, Livestock, Fisheries and Co-operatives
NGO	Non-Governmental Organizations
IMM	Integrated Manure Management
TIMPs	Technologies, Innovations and Management Practices
SWOT	Strengths Weaknesses Opportunities and Threats
ToTs	Training of Trainers
VC	Value Chain
VMGs	Vulnerable and Marginalized Groups

1. Definition of Terms And Summary Tables of Watermelon 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 KCSAP's case), can be commercialized and can be patented under intellectual property rights (IPR) arrangements. It consists of research outputs such as tools, equipment, genetic materials, breeds, farming and herding practices, gathering practices, laboratory techniques, models etc.

Management practice: This is 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 Watermelon Value Chain

The inventory process identified **135** TIMPs comprising **58** technologies, **11** innovations and **66** management practices, distributed among the **12** sub-themes, as indicated in Table 1.

Table 1: Summary of Watermelon TIMPs

Commodity/VC	Sub-theme	Technologies	Innovations	Management practices
Watermelon	Improved watermelon varieties	9	6	0
Watermelon	watermelon seed systems	3	2	0
Watermelon	Research Gaps and Food Safety	2	0	0
Watermelon	Agronomic Management Practices	7	0	0
Watermelon	Soil Fertility Management	3	2	0
Watermelon	Soil and Water Management	5	8	2

Watermelon	Watermelon Crop Health	26	16	5
Watermelon	Postharvest Management	4	3	0
Watermelon	Watermelon Value Addition	6	1	0
Watermelon	Mechanization of watermelon production activities	8	4	0
Watermelon	Watermelon Business and Marketing	5	0	0
Watermelon	Agricultural policy	7	1	0
Total		85	43	7

1.4 Summary of Status of Timps in Watermelon Value Chain

The inventory process resulted in a total of **85** TIMPs that are ready for upscaling, **43** TIMPs that require validation and **7** TIMPs that require further research in the sub-themes, as indicated in Table 2.

Table 1. Number of TIMPs ready for upscaling, require validation or further research

Commodity/VC	Sub-theme	Ready for upscaling	Require validation	Requires further research
Watermelon	Improved varieties	9	6	0
Watermelon	Seed systems	3	2	0
Watermelon	Research Gaps and food safety	2	0	0
Watermelon	Agronomic management practices	7	0	0
Watermelon	Soil fertility management	3	2	0
Watermelon	Soil and water management	5	8	2

Watermelon	Crop health	26	16	5
Watermelon	Postharvest management	4	3	0
Watermelon	Value addition	6	1	0
Watermelon	Mechanization of production activities	8	4	0
Watermelon	Business and marketing	5	0	0
Watermelon	Agricultural policy	7	1	0
Overall total		85	43	7

Table 2: Inventory of watermelon TIMPs by category and status

TIMPs sub-theme	TIMPs title	TIMPs category	Status
2.1 Improved watermelon varieties	2.1.1 Pata negra F ₁	Technology	Ready for upscaling
	2.1.2 Augusta F ₁	Technology	Ready for upscaling
	2.1.3 Sentinel F ₁	Technology	Ready for upscaling
	2.1.4 Fahari F ₁	Technology	Requires validation
	2.1.5 Sugar baby	Technology	Ready for upscaling
	2.1.6 Sukari F ₁	Technology	Ready for upscaling
	2.1.7 Crimson sweet	Technology	Ready for upscaling
	2.1.8 Charleston gray	Technology	Ready for upscaling
	2.1.9 Asali F ₁	Technology	Requires validation
	2.1.10 Anita F ₁	Technology	Requires validation
	2.1.11 Farao F ₁	Technology	Requires validation
	2.1.12 Astrakhan	Technology	Requires validation
	2.1.13 Julie F ₁	Technology	Requires validation
	2.1.14 Sweet Rose F ₁	Technology	Requires validation
	2.1.15 Zuri F ₁	Technology	Ready for upscaling
2.2 Watermelon Seed Systems	2.2.1. Tray sowing	Management practice	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.2.2. Direct seed sowing	Management practice	Ready for upscaling
	2.2.3. Seed pre-germination technique	Management practice	Ready for upscaling
	2.2.4 Propagation by grafting	Technology	Requires validation
	2.2.5 Propagation by cuttings	Innovation	Requires validation
2.3 Food Safety Management System	2.3.1 Hazard Analysis Critical Control Points (HACCP) plan for watermelon value chain in Kenya	Management practice	Ready for upscaling
	2.3.2 Good Agricultural Practice (Research Gaps) for watermelon	Management practice	Ready for upscaling
2.4 Agronomic Management Practices	2.4.1 Land preparation	Management practice	Ready for upscaling
	2.4.2 Crop spacing	Management practice	Ready for upscaling
	2.4.3 Watermelon pollination	Management practice	Ready for upscaling
	2.4.4 Crop rotation	Management practice	Ready for upscaling
	2.4.5 Weed management	Management practice	Ready for upscaling
	2.4.6 Plant pruning	Management practice	Ready for upscaling
	2.4.7 Plant training	Management practice	Ready for upscaling
2.5 Soil Fertility Management	2.5.1 Integrated manure management	Management practice	Requires validation

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.5.2 Integrated Soil Fertility Management (ISFM)	Management practice	Requires validation
	2.5.3 Rapid soil testing services	Innovation	Requires validation
	2.5.4 Low cost composting	Management practice	Requires validation
2.6 Soil and Water Management	2.6.1 Contour bunds	Management practice	Ready for upscaling
	2.6.2 Zai pits	Management practice	Ready for upscaling
	2.6.3 Bench terraces	Management practice	Ready for upscaling
	2.6.4 Fanya juu terraces	Management practice	Ready for upscaling
	2.6.5 Stone lines	Management practice	Ready for upscaling
	2.6.6. Retention ditches	Management practice	Ready for upscaling
	2.6.7. Grass strips	Management practice	Ready for upscaling
	2.6.8 Tied ditches	Management practice	Ready for upscaling
	2.6.9 Rain water harvesting systems (ponds and dams)	Management practice	Ready for upscaling
	2.6.10 Conservation Agriculture (CA)	Innovation	Ready for upscaling
	2.6.11 Watermelon-legume/cereal intercropping	Management practice	Requires further research
	2.6.12 Mulching	Management practice	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.6.13 Drip irrigation systems for small scale farmers	Technology	Ready for upscaling
2.7 Watermelon Crop Health	2.7.1 Integrated management of Melon/cotton Aphid (<i>Aphis gossypii</i>) in Watermelon	Management practice	Ready for upscaling
	2.7.2 Integrated management of Pickle worm/melon worm (<i>Diaphania hyalinata</i>) in Watermelon	Management practice	Ready for upscaling
	2.7.3 Integrated management of Leaf cutting beetle (<i>Diabrotica separata</i>) in Watermelon	Management practice	Ready for upscaling
	2.7.4 Integrated management of thrips (<i>Thrips palni</i>) in Watermelon	Management practice	Ready for upscaling
	2.7.5 Integrated management of white fly (<i>Bemisia tabaci</i>) in Watermelon	Management practice	Ready for upscaling
	2.7.6 Integrated management of Rind worm (<i>Liriomyza sp</i>) in Watermelon	Management Practice	Ready for upscaling
	2.7.7 Integrated management of Leaf miner (<i>Liriomyza sp</i>) in Watermelon	Management practice	Ready for upscaling
	2.7.8 Integrated management of Melon fly (<i>Bactrocera cucurbitae</i>) in Watermelon	Management practice	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.7.9 Integrated management of Red spider mite in Watermelon	Management practice	Ready for upscaling
	2.7.10 Integrated management of Root Knot nematodes in Watermelon	Management practice	Ready for upscaling
	2.7.11 Integrated management of Cut worm in Watermelon	Management practice	Ready for upscaling
	2.7.12 Integrated management of leaf eating caterpillar in Watermelon	Management practice	Ready for upscaling
	2.7.13 watermelon Integrated Weed Management	Innovation	Requires
	2.7.14 Mechanical weed control	Management practice	Ready for upscaling
	2.7.15 Crop rotation	Management practice	Ready for upscaling
2.8.1 Integrated Management of Watermelon Diseases	2.8.1 Integrated Management of Anthracnose disease in Watermelons	Management practice	Ready for upscaling
	2.8.2 Integrated Management of Powdery mildew disease in Watermelon	Management practice	Ready for upscaling
	2.8.3 Integrated Management of <i>Alternaria</i> leaf spot disease in Watermelon	Management practice	Ready for upscaling
	2.8.4 Integrated Management of Cucumber Mosaic Viral disease in Watermelon	Management practice	Ready for upscaling
	2.8.5 Integrated Management of Yellow	Management practice	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	Mosaic Viral disease in Watermelon		
	2.8.6 Integrated Management of Phytophthora blight in Watermelons	Management practice	Ready for upscaling
	2.8.7 Integrated Management of Fusarium wilt in Watermelon	Management practice	Ready for upscaling
	2.8.8 Integrated management of seedling blight (<i>Pythium</i> , <i>Rhizoctonia</i>) disease in Watermelon	Management practice	Ready for upscaling
	2.8.9 Integrated management of Rind and Bud Necrosis in Watermelon	Management practice	Ready for upscaling
	2.8.10 Integrated management of Bacterial Fruit Blotch disease in Watermelon	Management practice	Ready for upscaling
	2.8.11 Integrated management of Damping off disease in Watermelon	Management practice	Ready for upscaling
2.8 Harvest and postharvest management	2.8.1 Harvesting management of watermelon	Management practice	Requires validation
	2.8.2 Field assembling and packing	Management practice	Requires validation
	2.8.3 Control of postharvest diseases	Management practice	Ready for upscaling
	2.8.4 Sorting and grading	Management practice	Ready for upscaling

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.8.5 Storage of watermelon	Management practice	Requires validation
	2.8.6 Zero Energy Brick Cooler	Technology	Requires validation
	2.8.7 Evaporative Charcoal Cooler	Technology	Requires validation
2.9 Watermelon value addition	2.9.1 Watermelon slices	Technology	Ready for upscaling
	2.9.2 Watermelon juice	Technology	Ready for upscaling
	2.9.3 Watermelon wine	Innovation	Ready for upscaling
	2.9.4 Watermelon jam	Innovation	Ready for upscaling
	2.9.5 Watermelon powder	Innovation	Ready for upscaling
	2.9.6 Watermelon flour	Technology	Ready for upscaling
	2.9.7 Watermelon oil	Technology	Requires validation
2.10 Mechanization of watermelon 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	Technology	Requires further research
	2.10.6 Watermelons Transplanting	Management practice	Requires validation
	2.10.7 Seedling tray planter	Technology	Ready for upscaling
	2.10.8 Seedling transplanter	Technology	Requires validation


TIMPs sub-theme	TIMPs title	TIMPs category	Status
	2.10.9 Watermelon transplanter/weeder	Technology	Ready for upscaling
	2.10.10 Motorized sprayer	Technology	Ready for upscaling
	2.10.11 Fertilizer spreader	Technology	Ready for upscaling
	2.10.12 Watermelon harvesting	Technology	Requires further research
2.11 Business and Marketing	2.11.1 Models for market-oriented production of watermelon	Management practice	Ready for upscaling
	2.11.2 Developing a Business Plan for watermelon 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 watermelon Agro-enterprise	Management practice	Ready for upscaling
	2.11.5 Scaling up plan for watermelon agro-enterprise development approach	Management practice	Requires validation
	2.11.6 Contracted watermelon production model	Management practice	Requires upscaling
	2.11.7 Watermelon marketing enterprise model	Management practice	Ready for upscaling
	2.11.8 Internet/online/mobile marketing	Management practice	Ready for upscaling
2.12.1 Agricultural policy options	2.12.1 National Agricultural policy	Management practice	Requires validation

TIMPs sub-theme	TIMPs title	TIMPs category	Status
	framework for smallholder farmers of watermelon		
	2.12.2 Policy options and objectives related to watermelon farming	Management practice	Requires validation
	2.12.3 Instruments of policy related to watermelon	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	133		

2.0 Detailed Watermelon Value Chain Timps

2.1 Watermelon Varieties

Figure 1 Suitability map of Watermelon in Kenya

<p>2.1.1 TIMP Name</p>	<p>Pata negra F₁</p>  <p>Source: mallagro.com</p>
<p>Category (i.e. technology, innovation or management practice)</p>	<ul style="list-style-type: none"> • Technology
<p>A: Description of the technology, innovation or management practice</p>	
<p>Problem to be addressed</p>	<p>Limited diversity of watermelon varieties that are high yielding, tolerant to various stresses (biotic and abiotic), and suitable to different agroecological zones of the target counties</p>
<p>What is it? (TIMP description)</p>	<p>Pata negra F₁ is a green, round-shaped and crispy red-fleshed commercial variety which performs well in dry low humid conditions (15% to 20%) with minimal rainfall (650 to 1200mm per annum). It performs well in fertile and well drained soils (e.g sandy loams). It matures in 100-120 days and has the potential to yield about 46 tons/acre.</p>
<p>Justification</p>	<p>Pata negra F₁ does not only produce high fruit yields under various ecological conditions, humidity and soil types, but the fruits are also good quality (both in taste and appeal) making them suitable for local and export markets. Moreover, the mature fruits have</p>

	<p>thick rinds which is an essential trait for long distance transportation.</p> <p>Thus, the pata negra F₁ variety offers the farmers the opportunity to increase their production and subsequent income generation from local and export markets.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension service providers • Traders, • Processors • Consumers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call- in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors

	<ul style="list-style-type: none"> • Sufficient resources at county and national levels for extension and dissemination activities
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 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. • Financial Institutions- e.g. banks and donor communities to provide financial access and inclusion support systems. • Other service provider agencies including micro-finance agencies
C: Current situation and future scaling up	
Counties where already promoted. if any	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
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 promotion and publicity of the technology • No existing functional local processing and value-addition facilities • Low investment in research • Applied and adaptive Research to test, validate and release improved Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Prepare and package information for dissemination brochures. Upscale the technology at grass root level through FFBS • On-farm demonstrations at strategic places accessible to target farmers • Holding field days/open days


	<ul style="list-style-type: none"> • Involvement of private operators, other government agencies (County, KEPHIS and MoALFC-AFA), Non-governmental agencies, can fast track the up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • $0.5\text{kg seed/acre} \times 12,000 = 6,000/-$ per acre
Estimated returns	<ul style="list-style-type: none"> • $\text{Yield/acre} \times \text{Price/kg}$ $29,900 \text{ kg} \times 25/-$ per kg = 747,500/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men

	<ul style="list-style-type: none"> • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon 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	Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling

G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat. Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, Nairobi
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya-Maureen Namusonge
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

Research Gaps

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map

2.1.2 TIMP Name	<p>Augusta F₁</p>  <p>Source: Syngenta.co.in</p>
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Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Few commercially competitive varieties that are early maturing, widely adapted and that can withstand the rigours of long distance transportation.
What is it? (TIMP description)	Augusta F ₁ is variety that is Blackish Green with a deep red crispy flesh. It performs well in dry low humid conditions (15% to 20%) with minimal rainfall (650 to 1200mm per annum). The variety is best suited for growing in well drained and fertile sandy loam soils. It is early maturing, taking 85 to 90 days to mature and producing uniform fruit size with average weight of 7 to 10 kg. The variety has very good adaptability and is suitable/good for long distance transport
Justification	The variety is early maturing, high yielding, and has marketable good quality fruits that can withstand long distance transportation. The increased production empowers farmers to compete in the local and export market. This means that this technology has 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	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications

	<ul style="list-style-type: none"> • Technology shops • Call- in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
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	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot County
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low uptake before the farmers see results • Limited investment in the technology


	<ul style="list-style-type: none"> • 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"> • Prepare and package information for dissemination brochures. Upscale 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 up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • 0.35kg seed/acre x 16,000 = 5,600/- per acre
Estimated returns	<ul style="list-style-type: none"> • Yield/acre x Price/kg 11,700 kg x 25/- per kg = 292,500/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon 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	Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat. Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, Nairobi</p>
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya- Maureen Namusonge
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

Research Gaps

1. Determination of watermelon varieties suitable for different agro ecological zones
2. Production of watermelon suitability map

2.1.3 TIMP Name	Sentinel F₁  Source: Seednet
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Few commercially competitive varieties that are resistant/tolerant to various biotic and abiotic stresses suitable for different agro ecological zones of the target county.
What is it? (TIMP description)	Sentinel F₁ is a zebra type variety that is oblong in shape and has deep red juicy crispy sweet flesh. It performs well in dry moderate humid conditions (30% to 40%) with minimal rainfall (650 to 1200mm per annum). It is best suited for well drained and fertile loam soils. Sentinel F ₁ variety matures in 100-120 days and is high yielding producing uniform fruits weighing on average 11 – 14 kg and has potential yields of 50 tons/acre. It is extremely tolerant to Fusarium wilt and intermediately tolerant to Downy mildew.
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 Kenya
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers,

	<ul style="list-style-type: none"> • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call-in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • KALRO-Avail breeder’s seed and technical backstopping • Universities-Technical backstopping and tissue culture services • National and County Ministry of Agriculture, Livestock, Fisheries & Irrigation-Extension services • Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection • CBOs, NGO’s- Seed multiplication and technology dissemination • Processors: Create demand for variety • Farmers: Test/validate and produce


	<ul style="list-style-type: none"> • CGIARS e.g IITA: Donors: Funding and technical backstopping
C: Current situation and future scaling up	
Counties where already promoted. if any	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of watermelon 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"> • Prepare and package information for dissemination brochures. Upscale 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 up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities

	<ul style="list-style-type: none"> • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • 0.5kg seed/acre x 16,000 = 8,000/- per acre
Estimated returns	<ul style="list-style-type: none"> • Yield/acre x Price/kg 32,500 kg x 25/- per kg = 812,500/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products

	<ul style="list-style-type: none"> Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat. Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, Nairobi</p>
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya- Maureen Namusonge
Partner organizations	<ul style="list-style-type: none"> Ministry of Agriculture Livestock and Fisheries County Governments Local and International Seed & chemical companies Universities Farmer organizations Faith based organizations

Research Gaps

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map

<p>2.1.4 TIMP Name</p>	<p>Fahari F₁</p>  <p>Source: syngenta.co.zm</p>
<p>Category (i.e. technology, innovation or management practice)</p>	<ul style="list-style-type: none"> • Technology
<p>A: Description of the technology, innovation or management practice</p>	
<p>Problem to be addressed</p>	<p>Narrow diversity of commercially competitive varieties that are; early maturing, resistant/tolerant to various stresses (biotic and abiotic stresses), suitable for dry to moderately humid agro ecological zones of the target county, and can withstand long distance transportation.</p>
<p>What is it? (TIMP description)</p>	<p>Fahari F₁ is an early maturing type of watermelons (mature in 70 days) which has large oblong to oval shaped fruits with deep red crispy sweet flesh. The tough and thin fruit rind is a good trait for long shelflife and good keeping quality, thus can be transported to far markets. The variety is vigorous and is suitable for planting in warm open fields with well drained and fertile loam soils. It has good tolerance to anthracnose caused by <i>C. orbiculare</i> and fusarium wilt caused by <i>Fusarium oxysporum</i>. It performs well in dry moderate humid conditions (30% to 40%) with minimal rainfall (650 to 1200mm per annum). It produces 2 uniform fruits per vine with an average fruit size of 8kgs yielding 30 – 40 tons/acre.</p>
<p>Justification</p>	<p>The high yield attributes of this variety coupled with tolerance to major fungal diseases (i.e anthracnose caused by <i>C. orbiculare</i> and fusarium wilt caused by <i>Fusarium oxysporum</i>), sweet crispy fruits make it a</p>

	commercially competitive variety. It has the potential to increase production and subsequently leading income generation needed for transformed livelihoods of farmers in the country.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call- in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
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

	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of watermelon 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"> • Prepare and package information for dissemination brochures. Upscale 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

	<p>MoALFC-AFA), Non-governmental agencies, can fast track the up scaling of the technology.</p> <ul style="list-style-type: none"> • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • $0.5\text{kg seed/acre} \times 24,000 = 12,000/-$ per acre
Estimated returns	<ul style="list-style-type: none"> • $\text{Yield/acre} \times \text{Price/kg}$ $22,750 \text{ kg} \times 25/-$ per kg = $568,750/-$
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products

	<ul style="list-style-type: none"> • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat. Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, Nairobi</p>
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO

	Muguga South-David K. Lelgut, and Syngenta, Kenya-Maureen Namusonge
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

Research Gaps

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map

TIMP Name	Sugar Baby
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	There are few commercially competitive varieties that are early maturing, resistant/tolerant to various biotic and abiotic stresses and, suitable for dry to moderately humid agro ecological zones of the target counties.
What is it? (TIMP description)	Sugar baby is dark green, rounded watermelon variety that matures early (75 days). It performs well in dry moderate humid conditions (30% to 40%) with minimal rainfall (650 to 1200mm per annum). It is best suited for well drained and fertile sandy loam or red alluvial soils. The fruit weighs between 5 to 7kg giving yields of between 25 to 30 tons per acre. It is a sweet and fleshy variety which has a hard rind that makes it resistant to insect pests and gives it longer shelf life.
Justification	There is need to have more commercial varieties that are early maturing, resilient and high yielding to increase production for farmers in Watermelon 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)

	<ul style="list-style-type: none"> • Consumers
Approaches to be 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 • 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 Watermelon varieties • A platform for interaction of Watermelon 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	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
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 Watermelon varieties • A platform for interaction of Watermelon 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 Watermelon innovation platforms
Lessons learned in up scaling, if any	
Social, environmental, policy and market conditions necessary for development and up-scaling	<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	<ul style="list-style-type: none"> • $0.5\text{kg seed/acre} \times 5,150 = 2,575/-$ per acre
Estimated returns	<ul style="list-style-type: none"> • $\text{Yield/acre} \times \text{Price/kg}$ $17,550 \text{ kg} \times 25/-$ per kg = 438,750/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in

	<p>performing the various crop's activities such as planting and weeding</p> <ul style="list-style-type: none"> • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon 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	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • . Ready for upscaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT Email:kalro.perkerra@kalro.org</p>
Lead organization and scientists	<p>KALRO-Perkerra - Jimmy K. Yegon, Timon Moi (GeRRI), Dr. Lusike Wasilwa (KALRO HQ), David K.</p>

	Lelgut (KALRO Muguga South) and Maureen Namusonge (Syngenta, Kenya)
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture • Seed and chemical companies • Universities

Research Gaps

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map

TIMP Name	<p>Sukari F1</p>  <p>Source: famunera.com</p>
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	There are few commercially competitive varieties that are early maturing, high yielding, resistant/tolerant to various biotic and abiotic stresses, suitable for different agro ecological zones of the target counties.
What is it? (TIMP description)	Sukari F1, a zebra type watermelon, is a strong and vigorous variety having oblong fruits with green striped skin and very sweet red flesh. It performs well in dry low humid conditions (15% to 20%) with minimal rainfall (750 to 1300mm per annum). This variety is best suited for well drained and fertile loam soils. The variety matures 85 days after planting, yielding fruits weighing 10 – 12kgs each and yield potential is 30 – 40 tons per acre. The fruit has excellent storage and transportability traits. It is also resistant/tolerant to Fusarium and Anthracnose.

Justification	The high yield attributes of this variety coupled with tolerance to Fusarium wilt and Anthracnose, its excellent storage and transportability traits in addition to the very sweet flesh makes it suitable for production with other varieties for its marketable potential towards increased yields hence transforming farmers' livelihoods in West Pokot County.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Extension service providers • Consumers • processors
Approaches to be 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 • Mobile phone and online applications • Technology shops • Call-in Q & A centres
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 • Excellent storage and transportability traits enabling the technology to sell at distant markets. • Adaptive Research to test, validate and release improved Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments
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.

	<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 • Sufficient and strong collaborations amongst stakeholders
C: Current situation and future scaling up	
Counties where already promoted, if any	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
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 • Adaptive Research to test, validate and release improved Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • 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"> • 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 Watermelon innovation platforms
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<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	<ul style="list-style-type: none"> • 0.5kg seed/acre x 24,000 = 12,000/- per acre
Estimated returns	<ul style="list-style-type: none"> • Yield/acre x Price/kg 22,750 kg x 25/- per kg = 568,750/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon 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	<ul style="list-style-type: none"> Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT Email:kalro.perkerra@kalro.org</p> <p>East African Seed Company Kijabe street Branch P. O Box 45125-00100 NAIROBI</p>
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, Timon Moi (GeRRI), Dr. Lusike Wasilwa (KALRO HQ), David Lelgut (KALRO Muguga South and Maureen Namusonge (Syngenta, Kenya)
Partner organizations	<ul style="list-style-type: none"> Ministry of agriculture Livestock and Fisheries Seed and chemical companies Universities

Research Gaps

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map

TIMP Name	<p>Crimson Sweet</p>  <p>Source: alabama.com</p>
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Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	There are few commercially competitive varieties that are resistant/tolerant to various biotic and abiotic stresses and that have good shelf life.
What is it? (TIMP description)	Crimson Sweet watermelon fruit has a green rind and dark green stripes with deep red sweet flesh. It matures in 85-120 days and the fruit can weigh between 8-10kgs. Crimson Sweet watermelon is resistant to extreme heat, Fusarium rot, anthracnose; and Root-knot Nematodes. It has a good shelf life.
Justification	The high yield attributes and tolerance to Fusarium rot, anthracnose, and Root-knot Nematodes coupled with resistance to extreme heat makes this variety suitable for commercial production. The variety is high yielding and its fruits are marketable towards increased production leading to farmers' transformed livelihoods in target County.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Extension service providers • Consumers • Processors
Approaches to be 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) • Agriculture Innovation Platforms • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call-in Q & A centres


Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Stakeholder capacity building • Efficient pest and disease management • Tolerance/resistance to extreme heat • Increasing productivity per unit • Adaptive research carried out on the variety to compare performance with others • A platform for interaction of watermelon value chain stakeholders • Access to media, mobile and online tools
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • 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	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
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 Watermelon varieties • Lack of watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders • Unorganized marketing channels
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 Watermelon innovation platforms • Involvement of private operators, other government agencies (County, KEPHIS and MOALFC_AFFA), NGO's can fastrack scaling up of the technology
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<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	<ul style="list-style-type: none"> • $0.5\text{kg seed/acre} \times 6,350 = 3,175/-$ per acre
Estimated returns	<ul style="list-style-type: none"> • $\text{Yield/acre} \times \text{Price/kg}$ $22,750 \text{ kg} \times 25/-$ per kg = $568,750/-$
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men

	<ul style="list-style-type: none"> • 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 in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT Email:kalro.perkerra@kalro.org East African Seed Company Kijabe street Branch P. O Box 45125-00100 NAIROBI</p>
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, Timon Moi (GeRRI), Dr. Lusike Wasilwa (KALRO HQ), David Lelgut (KALRO Muguga South) and Maureen Namusonge (Syngenta, Kenya)
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture • Seed and chemical companies • Universities

Research Gaps

- 1 Determination of watermelon varieties adaptable to different agro ecological zones
- 2 Production of watermelon suitability map

TIMP Name	Charleston Grey  Source: americansseedco.com
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	There are few commercially competitive varieties that are resistant/tolerant to various biotic and abiotic stresses and suitable for dry agro ecological zones of the target county, and can withstand rigours of long distance transportation.
What is it? (TIMP description)	Charleston Grey has very elongated and oblong shape, with light fruit skin and striped with a hard rind. At maturity, rind color turns to light green, and the flesh is sweet, juicy and crunchy. Charleston Grey matures in 80 – 85 days after planting, yielding fruits with average weight of 8 – 10 kg giving at least 20 tons per acre. The variety is tolerant to Fusarium and Anthracnose. It is also drought resistant and is able to withstand long transportation.
Justification	The high yield attributes of this variety coupled with tolerance to Fusarium wilt and Anthracnose, its capability to withstand long distant transportation and its sweet flesh make it a suitable candidate for up scaling towards increased production leading to farmers’ transformed livelihoods in West Pokot County.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension service providers • Researchers

	<ul style="list-style-type: none"> • Traders • Seed Dealers • Consumers • Processors
Approaches to be 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 communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Mobile phone and online applications • Technology shops • Call-in Q & A centres
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Carry out adaptive Research to catalyze uptake of the improved watermelon variety • Development of agronomic practices for watermelon for Increasing productivity per unit • Establish a platform for interaction of watermelon value chain stakeholders • Participatory Implementation • Stakeholder capacity building • Stakeholder networks • Efficient pest and disease management • Access to media, mobile and online tools • Sufficient resources at county and national levels for extension and dissemination activities
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


	<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. • 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	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of watermelon 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 watermelon 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 learned in up scaling, if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the technology • Availability of market
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Optimum yields obtained

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • 0.5kg seed/acre x 1,750 = 875/- per acre
Estimated returns	<ul style="list-style-type: none"> • Yield/acre x Price/kg 13,000 kg x 25/- per kg = 325,000/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional high value in other parts of Kenya.

	<ul style="list-style-type: none"> • Technology adoption among private players and NGOs is increasing • Individual farmers who have planted the variety are on the increase
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • . Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT Email:kalro.perkerra@kalro.org East African Seed Company Kijabe street Branch P. O Box 45125-00100 NAIROBI</p>
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, Timon Moi (GeRRI), Thomas Chebii, Dr. Lusike Wasilwa (KALRO HQ), David K. Lelgut (KALRO Muguga South) and Maureen Namusonge (Syngenta, Kenya)
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture • Seed and chemical companies • Universities

Research Gaps

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map

TIMP Name	Asali F₁ 
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited diversity of watermelon varieties that are high yielding, tolerant to various stresses (biotic and abiotic), and suitable to different agroecological zones of the target counties. In addition the fruits need to have long shelflife and withstand long distance transportation.
What is it? (TIMP description)	Asali F₁ watermelon variety produces large oblong shaped fruits with dark green striped skin rind and very sweet flesh. It performs well in slightly dry conditions characterized by low relative humidity (20% to 30%) with minimal rainfall (650 to 900mm p.a.) This variety is best suited for well drained and fertile loam soils. It is also resistant/tolerant to Fusarium and Anthracnose fungal diseases. The fruit will take around 85 days to fully mature. Asali F ₁ yield up to 40 tons per acre. The fruits have excellent shelflife and can withstand long distance transport.
Justification	The high yield attributes of this variety combined with the tolerance to Fusarium and anthracnose, and its excellent shelflife and ability to withstand long distance transport make it a commercially competitive variety. Thus, it has the potential to increase production and subsequent income generation to farmers in the Country.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers,

	<ul style="list-style-type: none"> • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call- in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
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

	<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. • 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	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of watermelon 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"> • Prepare and package information for dissemination brochures. Upscale 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 up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand.


	<ul style="list-style-type: none"> • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • $0.5\text{kg seed/acre} \times 24,000 = 12,000/-$ per acre
Estimated returns	<ul style="list-style-type: none"> • $\text{Yield/acre} \times \text{Price/kg}$ $26,000 \text{ kg} \times 25/-$ per kg = 650,000/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men

	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon 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	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, Nairobi</p>
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya-Maureen Namusonge

Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations
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Research gap

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map

TIMP Name	<p>Anita F1</p>  <p>Source: kangarooseeds.com</p>
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Few commercially competitive varieties that are resistant/tolerant to various stresses (biotic and abiotic), suitable for dry agroecological zones of the target counties, and can withstand rigours of long distance transportation.
What is it? (TIMP description)	Anita F1 hybrid variety have excellent oval to oblong striped fruit. It has glossy attractive high-quality fruits with deep crimson red flesh, the fruit texture is very crispy and sweet. The hybrid watermelon variety is suitable for growing indoor and mostly in the open field. It performs well in dry moderate humid conditions (30% to 40%) with minimal rainfall (650 to 1200mm per

	<p>annum). This variety is best suited for well drained and fertile loam soils. There is evidence the variety has tolerance to Anthracnose and Fusarium wilt diseases. Anita F₁ takes 80-85 days to mature, giving an average fruit weight of 8-10kg translating to yield potential of 40 – 50 tons per acre. The fruits have excellent transport quality fit for long distance transportation.</p>
Justification	<p>High yields, tolerance to Anthracnose and Fusarium wilt and the ability to withstand transportation rigours are the attributes that make Anita F₁ variety a good candidate for increasing production and income generation in Watermelon producing counties.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call- in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders

	<ul style="list-style-type: none"> • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
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	-
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of watermelon 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"> • Prepare and package information for dissemination brochures. Upscale 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 up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • $0.5\text{kg seed/acre} \times 24,000 = 12,000/-$ per acre
Estimated returns	<ul style="list-style-type: none"> • $\text{Yield/acre} \times \text{Price/kg}$ $29,250 \text{ kg} \times 25/-$ per kg = $731,250/-$
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men

	<ul style="list-style-type: none"> • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403

	<p>MARIGAT</p> <p>Email:kalro.perkerra@kalro.org</p> <p>Syngenta, Kenya</p> <p>P.o Box 30393-00100,</p> <p>Nairobi</p>
Lead organization and scientists	<p>KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya-Maureen Namusonge</p>
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

Research Gaps

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map

TIMP Name	<p>Farao F1</p>  <p>Source: nakheelagri.com</p>
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	

Problem to be addressed	Narrow diversity of commercially competitive varieties that are; early maturing, resistant/tolerant to various stresses (biotic and abiotic stresses), suitable for dry to moderately humid agro ecological zones of the target county, and can withstand long distance transportation.
What is it? (TIMP description)	Farao F₁ hybrid produces large elongated blocky shaped fruits of medium-green colour with broad, medium dark-green stripes. The fruit are characterized by flavorful, dark red flesh texture with high sugars and small brown seeds. It performs well in dry moderate humid conditions (30% to 40%) with minimal rainfall (650 to 900mm per annum). This variety is best suited for well drained and fertile loam soils. Farao F ₁ is a medium-early watermelon variety taking 75-85 days to mature. It is a high yielding variety exhibiting strong plant vigour with a very good vine growth habit. It shows excellent uniformity and fruit set with high interior quality. The fruit have medium thick but durable rind suitable for long distance shipping.
Justification	High yielding, marketable with good shelf-life varieties capable of withstanding long distant shipping are necessary to increase production for farmers in Watermelon producing counties. The variety commercially competitive in the market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms

	<ul style="list-style-type: none"> • Mobile phone and online applications • Technology shops • Call- in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
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	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot


<p>Challenges in development and dissemination</p>	<ul style="list-style-type: none"> • Lack of watermelon 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.
<p>Suggestions for addressing the challenges</p>	<ul style="list-style-type: none"> • Prepare and package information for dissemination brochures. Upscale 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 up scaling of the technology. • Establish Watermelon innovation platforms
<p>Lessons learned in up scaling, if any</p>	<p>-</p>
<p>Social, environmental, policy and market conditions necessary for development and up-scaling</p>	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • 0.5kg seed/acre x 24,000 = 12,000/- per acre
Estimated returns	<ul style="list-style-type: none"> • Yield/acre x Price/kg 22,750 kg x 25/- per kg = 568,750/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	

Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets.
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, Nairobi</p>
Lead organization and scientists	<p>KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya- Maureen Namusonge</p>
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

Research Gaps

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map

TIMP Name	Astrakhan  <p>Source: ebay.com</p>
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Narrow diversity of commercially competitive varieties that are; early maturing, resistant/tolerant to various stresses (biotic and abiotic stresses), suitable for dry to moderately humid agro ecological zones of the target county, and can withstand long distance transportation.
What is it? (TIMP description)	Astrakhan fruits are oval-shaped (long blocky) and have medium thick rind with a dark green stripe with mottling on a medium green background. The flesh is pink and the seeds seem to vary in color - can be buff, orange or brown. It has a wonderful, delicious, delicate sweetness. It performs well in dry moderate humid conditions (30% to 40%) with minimal rainfall (650 to 1200mm per annum). This variety is best suited for well drained and fertile sandy-loam soils. The variety is highly resistant to fungal diseases. The fruits are of uniform medium to large in size each weighing 12 - 14 kg, with small seeds and red flesh. Astrakhan is medium - early watermelon variety maturing in 85 – 95 days with good quality fruits having a vivid red flesh colour.
Justification	The high yield attributes of this variety combined with the resistance to various diseases, and the good quality fruits, make it a suitable variety for evaluation with other varieties for its marketable potential. This is with the objective of increasing production and subsequent income generation for improved livelihoods of farmers in the country.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call- in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
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.)


	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of watermelon 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"> • Prepare and package information for dissemination brochures. Upscale 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 up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand.

	<ul style="list-style-type: none"> • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • 0.5kg seed/acre x 24,000 = 12,000/- per acre
Estimated returns	<ul style="list-style-type: none"> • Yield/acre x Price/kg 22,750 kg x 25/- per kg = 568,750/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men

	<ul style="list-style-type: none"> • 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 in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, Nairobi</p>
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya- Maureen Namusonge
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

Research gap

1. Determination of watermelon varieties adaptable to different agro ecological zones

TIMP Name	<p>Julie F₁</p>  <p>Source: smartfarmingug.com</p>
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Narrow diversity of commercially competitive varieties that are; early maturing, resistant/tolerant to various stresses (biotic and abiotic stresses), suitable for dry to moderately humid agro ecological zones of the target county, and can withstand long distance transportation..
What is it? (TIMP description)	Julie F₁ variety has Oblong shape with skin that has green stripes. It is a high yielding hybrid watermelon which performs well in dry moderate humid conditions (30% to 40%) with minimal rainfall (650 to 1200mm per annum). This variety is best suited for deep, well drained and fertile loam soils due to an extensive growth habit of its roots. Julie F ₁ is tolerant to Fusarium wilt and anthracnose fungal diseases. It matures in 80-85days. The fruit of this variety weigh 8 -10kg and has excellent bright red flesh with good juicy granular texture and sweetness.
Justification	The variety has high yield attributes coupled with good attrinutes such as; tolerance to fungal diseases (Fusarium wilt and Anthracnose), and sweet bright red fruits with juicy granular texture. These traits makes it a suitable candidate for evaluation with other commercial varieties for their market potential. This is with the objective of increasing the production and subsequent income generation for improve livelihoods of farmers in the country.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call- in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
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

	<p>Company, East Africa Seed, Continental Seed Company etc.)</p> <ul style="list-style-type: none"> • 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	
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of watermelon 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"> • Prepare and package information for dissemination brochures. Upscale 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 up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	-


<p>Social, environmental, policy and market conditions necessary for development and up-scaling</p>	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • Understanding the physical and biotic Environment in target ecologies • Understanding community culture, preferences, and practices
<p>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</p>	
<p>Basic costs</p>	<ul style="list-style-type: none"> • $0.5\text{kg seed/acre} \times 23,000 = 11,500/-$ per acre
<p>Estimated returns</p>	<ul style="list-style-type: none"> • $\text{Yield/acre} \times \text{Price/kg} 29,250 \text{ kg} \times 25/- \text{ per kg} = 731,250/-$
<p>Gender issues and concerns in development, dissemination, adoption and scaling up</p>	<ul style="list-style-type: none"> • Women have less access to agricultural information, technology and knowledge than men • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men • Women have less access to markets and market information than men
<p>Gender related opportunities</p>	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding

	<ul style="list-style-type: none"> • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, Nairobi</p>
Lead organization and scientists	<p>KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya- Maureen Namusonge</p>

Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations
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Research Gaps

- 1 Determination of watermelon varieties adaptable to different agro ecological zones
- 2 Production of watermelon suitability map

TIMP Name	<p>Sweet Rose F₁</p>  <p>Source: agroduka.com</p>
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Narrow diversity of commercially competitive varieties that are; early maturing, resistant/tolerant to various stresses (biotic and abiotic stresses), suitable for dry to moderately humid agro ecological zones of the target county, and can withstand long distance transportation.
What is it? (TIMP description)	Sweet Rose F₁ is oval to round in shape, vigorous with good adaptability and has good keeping quality. It performs well in dry low humid conditions (10% to 25%) with minimal rainfall (650 to 850mm per annum). This variety is best suited for well drained and fertile loam soils with a neutral pH. Can be harvested in 100 days yielding fruits that can weigh between 10 and 12kgs. The fruits can resist sunburns. The flesh is deep crimson red in colour with good texture. It has a good shelf life.

Justification	The high yield attributes of this variety coupled with good fruit qualities such as sweet crispy fruits make it a commercially competitive variety. It has the potential to increase production and subsequently leading income generation needed for transformed livelihoods of farmers in the country.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call-in Q & A centres
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities

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	
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of watermelon 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"> • Prepare and package information for dissemination brochures. Upscale the technology at grass root level through FFBS • On-farm demonstrations at strategic places accessible to target farmers • Holding field days/open days


	<ul style="list-style-type: none"> • Involvement of private operators, other government agencies (County, KEPHIS and MoALFC-AFA), Non-governmental agencies, can fast track the up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • $0.5\text{kg seed/acre} \times 24,000 = 12,000/-$ per acre
Estimated returns	<ul style="list-style-type: none"> • $\text{Yield/acre} \times \text{Price/kg}$ $22,750 \text{ kg} \times 25/-$ per kg = $568,750/-$
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men

	<ul style="list-style-type: none"> • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon 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	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	

Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, Nairobi
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya- Maureen Namusonge
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

Research Gaps

- 1 Determination of watermelon varieties adaptable to different agro ecological zones
- 2 Production of watermelon suitability map

TIMP Name	Zuri F1  Source: East African Seed Co.
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	

Problem to be addressed	Limited diversity of commercially competitive varieties that are early maturing, widely adapted and can withstand long distance transportation.
What is it? (TIMP description)	Zuri F₁ variety of watermelon has fruits that have a strong rind and are dark green in colour, weighing as much as 12 kg. It performs well in dry and very low humid conditions (10% to 15%) with minimal rainfall (450 to 750mm per annum). This variety is best suited for well drained and fertile sandy loam soils with neutral to slightly acidic pH. The variety is also resistant to strains of <i>Fusarium wilt</i> . The variety has the potential to yield 23 to 25 tons/acre.
Justification	The high yield attributes of this variety coupled with tolerance to <i>Fusarium oxysporum</i> , and its performance in dry areas with very low humidity makes it a suitable candidate for commercial production. It has the potential of increasing production and generation of income for improved livelihoods in the producing counties
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Extension service providers • Traders, • Processors • Consumers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Technology shops • Call-in Q & A centres
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

	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release improved Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
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 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. • Financial Institutions- e.g. banks and donor communities to provide financial access and inclusion support systems. • Other service provider agencies including micro-finance agencies
C: Current situation and future scaling up	
Counties where already promoted, if any	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
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 promotion and publicity of the technology • No existing functional local processing and value-addition facilities • Low investment in research • Applied and adaptive Research to test, validate and release improved Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders

Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Prepare and package information for dissemination brochures. Upscale 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 up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive since the variety is registered and is appealing for market demand. • Establishment of fair marketing channels for the produce devoid of exploitation of farmers by market actors. • Establishing elaborate infrastructure for storage, grading and warehousing • Identifying relevant financiers to support value chain activities • Gender inclusiveness in crop research and development • Capacity building of all stakeholders in the value chain • 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	<ul style="list-style-type: none"> • $0.5\text{kg seed/acre} \times 24,000 = 12,000/-$ per acre
Estimated returns	<ul style="list-style-type: none"> • $\text{Yield/acre} \times \text{Price/kg}$ $15,600 \text{ kg} \times 25/-$ per kg = 390,000/-
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 • Women perform most of the weeding and processing activities • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men


	<ul style="list-style-type: none"> • Women have less access to farm implements than men • Women have less access to markets and market information than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in the production and marketing the produce through ICT and semi-processed or value added products • Employment opportunities exist for women in performing the various crop's activities such as planting and weeding • Affirmative action opportunities such as the women fund exists for women to access the required credit.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed in Watermelon production and marketing through ICT and semi-processed or value added products • Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon production manuals and variety factsheets/ leaflets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p>

	Email:kalro.perkerra@kalro.org Syngenta, Kenya P.o Box 30393-00100, NAIROBI
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut, and Syngenta, Kenya-Maureen Namusonge
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

Research Gaps

1. Determination of watermelon varieties adaptable to different agro ecological zones
2. Production of watermelon suitability map


2.2 Watermelon Seed Systems

2.2.1 TIMP Name	Tray Sowing Technique  Source; bhg.com.au
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor seed germination, poor plant uniformity and moisture stress are commonly encountered in direct watermelon field planting. The

	emerging seedlings in the field are tender and more vulnerable to pest and disease attack and often lowers the crop yield potential.
What is it? (TIMP description)	Tray sowing is a technique that involves placement of watermelon seed in moist soilless media contained in portable trays under a confined environment either in the nursery shade or in the greenhouse. The soilless media is mixed with plant nutrients in form of fertilizers and pesticides/fungicides are applied to control pests and diseases using the recommended application rates. The trays can easily be transported or moved from one environment to another within the nursery and to the transplanting field. Ready seedlings are transplanted to the field after hardening – off.
Justification	Seedlings sown in trays escape stresses such contributed by low soil moisture, unviability of seed, poor soil workability and other field pests and diseases that affect directly sown seeds. The technique facilitates establishment of a good crop stand since the hardened seedlings are transplanted at the right stage when most seedling mortality causes can be controlled or avoided.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, nursery operators, Traders, Researchers, Extension service.
Approaches to be 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 successful promotion	<ul style="list-style-type: none"> • Seed availability and accessibility • 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

	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Large commercial agro-based companies
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
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 learned in up scaling, if any	<ul style="list-style-type: none"> • Raising seedlings in tray can allow farmers to transplant the seedlings and irrigate as they await expected rain therefore spread production.
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Channeling of more recourses on the promotion of the management practices to create more awareness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 4,000
Estimated returns	<ul style="list-style-type: none"> • Can be established by research
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 on production of seedlings in trays than men • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have less access to farm implements than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women on watermelon seedling production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities

	<ul style="list-style-type: none"> • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in Watermelon seedlings production and marketing • Watermelon is nutritious and well adopted in the country hence will act as a food security crop for the VMGs
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon Production Manual and sowing methods factsheets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling
G: Contacts	
Contacts	<p>Institute Director</p> <p>Apiculture and Beneficial Insects Research Institute</p> <p>P.O. Box 32-30403</p> <p>MARIGAT</p>
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, Thomas K. Chebii, Timon Moi (GeRRI), Dr. Lusike Wasilwa (KALRO HQ), David Lelgut (KALRO Muguga North)
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture • Seed and chemical companies • Universities

2.2.2 TIMP Name	Direct Seed Sowing Technique 
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Non-direct methods of sowing require special skill hence are a little costly. Poor field establishment may arise from plants whose roots have been disturbed as well as difficulty for the plants to adapt when introduced from another environment.
What is it? (TIMP description)	Direct sowing involves digging a shallow hole, between 1.2 cm and 1.9 cm deep into which 2 – 6 seeds are placed and covered with fine soil. It should be done when the soil is moist to facilitate the seeds to imbibe water and temperatures between 21 ⁰ C to 28 ⁰ C for germination to take place.
Justification	Application of direct sowing as a management practice contribute to significant cost reduction and drought stress management both playing a key role in lowering expenditure while increasing output respectively in Watermelon production. Less skill is required as the practice is traditionally applied in most plants and utilizes the natural conditions.
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"> • On-farm demonstration • Field days • Agricultural shows • MoALFC/Extension officers • Farmer to farmer • Mass media – “Mkulima programme”

	<ul style="list-style-type: none"> • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets) • Use of mobile APPs • Farmer Field and Business Schools • Call-in Q and A centres
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Awareness of challenges of low germination in the field. • High cost certified seed hence the need to minimize losses at planting • Awareness of benefits seedling resilience brought about by direct sowing • The need for adequate field preparation before planting.
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.
C: Current situation and future scaling up	
Counties where already promoted. if any	<ul style="list-style-type: none"> • Baringo, Elgeyo- Marakwet, all other watermelon producing counties
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • 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, Farmer Field and Business Schools
Lessons learned in up scaling, if any	
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Optimum yields obtained
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 2,000 per acre
Estimated returns	<ul style="list-style-type: none"> • To be established by research

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 on production of seedlings in trays than men • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth and women in performing the task
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth in performing the task . • Watermelon is nutritious and well adopted in the country hence will act as a food security crop for the VMGs
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<ul style="list-style-type: none"> • Moi T.K., et al. Production of Watermelon: A Livelihood Improvement Venture in Baringo County of Kenya • Daniel S. Egel and Ray Martyn., Planting Method, Plastic Mulch, and Fumigation Influence Growth, Yield, and Root Structure of Watermelon, HORTSCIENCE 43(5):1410–1414. 2008
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra</p> <p>P.O. Box 32-30403</p> <p>MARIGAT</p>

Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, Timon Moi (GeRRI), Dr. Lusike Wasilwa (KALRO HQ), David Lelgut (KALRO Muguga North)
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture • Seed and chemical companies • Universities

2.2.3 TIMP Name	Seed Pre-germination Techniques
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Complementary Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Field conditions are dependent on the natural environment which may pre-dispose a viable seed to low soil moisture, pests and diseases that lead to low seed germination. The ungerminated seeds are responsible for Research Gaps left in the field after sowing of the seeds.
What is it? (TIMP Description)	The technique of seed pre-germination facilitates faster sprouting of the coleoptile as a means of starting germination for its continuity in other growth phases upon its transfer to the field. It thus reduces the time taken before a seed germinates, limiting its exposure at seedling growth phase to biotic and abiotic stresses.
Justification	Pre-germination gives a viable seed the chance to sprout faster, minimizing losses due to abiotic and biotic stresses that lead to seed mortality.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, nursery operators, Researchers, Extension service.
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On station research trials and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer research networks • Farmer to farmer communication • Promotional materials (posters/brochures/leaflets, manuals) • Mobile phone and online applications

	<ul style="list-style-type: none"> • Farmer Field Business Schools • Innovation Platforms On-farm demonstration • Technology shops • Call-in Q & A centres
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 the technology • Lack of awareness by most nursery operators and farmers • Formation of a platform for interaction of watermelon value chain stakeholders • Access to media, mobile and online tools • Sufficient resources at county and national levels for extension and dissemination activities
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • KALRO Seed Unit • Private seed companies for availing quality seed (Syngenta, Amiran, Simlaw/Kenya Seed Company, East Africa Seed Company etc) • Market players to create a demand and pull production • Farmers/farmer groups to adopt and propagate seedlings • Research organizations, universities will do more research on the technology • 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 • 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
C: Current situation and future scaling up	
Counties where already promoted, if any	<ul style="list-style-type: none"> • Baringo
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Most farmers have not embraced the technology of propagation by pre germinating seeds. • Lack of watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders

	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Limited investment in the technology
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Prepare and package information for dissemination in brochures on the advantages of using trays to trigger demand • Scaling up and promotion of existing nurseries on embracing the management practice • 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 up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • The policy environment is conducive since the technique is documented and is appealing for market demand. • Establishment of fair marketing channels for the pre-germinated material devoid of exploitation of farmers by market actors. • Identifying relevant financiers to support value chain activities • Gender inclusiveness and awareness creation of the technique • Capacity building of all stakeholders in the value chain • Willingness by farmers to test the technique and work with nursery operators • Group members (CIGs) opportunities to adopt the technique
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 4,000 per acre
Estimated returns	<ul style="list-style-type: none"> • To established through research
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 on seed pre- germination technique than men • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have limited access to education, training and extension services than men

Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women and men in watermelon production and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering from drugs in watermelon production and marketing • Watermelon is nutritious and well adopted in the country hence will act as a food security crop for the VMGs
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> •
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon brochure
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, Timon Moi (GeRRI), Dr. Lusike Wasilwa (KALRO HQ), David Lelgut (KALRO Muguga North)
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture • Seed and chemical companies • Universities


2.2.4 TIMP Name	Propagation by cuttings
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology

A: Description of the technology, innovation or management practice	
Problem to be addressed	Hybrid seeds are expensive and lack homogeneity in their germination even when sown at the same time. Propagation by cuttings is an opportunity that will considerably reduce such costs as well as achieve uniformity of plants.
What is it? (TIMP Description)	Cutting is a method of asexual plant propagation widely used in horticulture. It is most commonly used for the propagation of trees and shrubs grown commercially. In vegetable crops cuttings are used on sweet potato and cassava as a commercial propagation method and cuttings can be used as a commercial propagation method in watermelon, potato, eggplant, cucumber and melon.
Justification	The seedless watermelon (triploid hybrid watermelon) seeds are very expensive, do not germinate well and show least homogenous germination and growth. For these reasons, there is need to propagate seedless watermelon by cuttings to minimize the amounts of imported watermelon hybrid seeds hence reducing the cost of production and also producing homogenous plants.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers • Nursery operators • Traders • Researchers, Extension service
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Seminars, Meetings, trainings • Promotional materials (posters/brochures/leaflets)
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools

	<ul style="list-style-type: none"> • Favourable legal and regulatory environments
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	-
Counties where TIMPs will be upscaled	West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Cuttings may have difficulty fruiting if they're taken too late in the season.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Taking cutting from a plant grown completely indoors
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> •
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Channeling of more recourses on the promotion of the technology to create more awareness • Establishing elaborate protocols for effective demand driven production of rooted cuttings • Awareness creation to stakeholders, farmers, relevant financiers along the value chain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 4,000 per acre
Estimated returns	<ul style="list-style-type: none"> • To be established through research
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

	<ul style="list-style-type: none"> • Men perform most of the propagation activities therefore the technology may increase their work burden. • Women and youth have limited access to productive resources such as land, credit, and quality seeds than men • Women have limited access to education, training and extension services than men
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth in production and marketing the produce through ICT
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men • VMGs have less access to agricultural information, technology and knowledge than men • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for unemployed youth and those recovering from drugs in Watermelon production and marketing through ICT • Watermelon 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
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Watermelon Production Manual and Propagation Methods Factsheets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT

Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, Timon Moi Thomas K. Chebii (GeRRI), Dr. Lusike Wasilwa (KALRO HQ), David Lelgut (KALRO Muguga North)
Partner organizations	<ul style="list-style-type: none"> • Seed and chemical companies, • Universities other research organizations

2.2.5 TIMP Name	<p>Propagation by grafting</p>  <p>Source: dreamstime.com</p>
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Directly sown seeds experience both favourable and unfavourable conditions in the soil such as salinity, soil-borne pests and diseases. Such stresses retard growth or lead to death eventually impact negatively on yield performance in watermelon.
What is it? (TIMP Description)	Grafting of watermelon scions on squash, pumpkin, or bottle gourd rootstocks is practiced in many of the major watermelon production regions of the world. This method involves the use of vegetative parts of a young watermelon seedling as scion and rootstock seedling being pumpkin or bottle gourd or any other mentioned above. The rootstock

	seedling should have at least one true leaf and the scion seedling should have one or two true leaves.
Justification	The primary reason for grafting vine crops is to protect against soil-borne diseases (e.g., Fusarium wilt, Verticillium), resistance to nematodes especially root-knot nematode <i>Meloidogyne</i> spp. Additional benefits include potential increase in yield and improved fruit quality. Grafting also helps to manage salinity in soil and irrigation water, commonly used in cultivation of watermelon.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, nursery operators • Traders, • Researchers, • Extension service
Approaches to be 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 and Business Schools • Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Seed availability and accessibility • Good seed system to ensure quality seeds for rootstocks and improved variety scionwoods • Trained nursery operators on grafting skills and good nursery management practices. • Well organized farmer groups and networks • Participatory Implementation • Stakeholder capacity building • Increasing productivity per unit • Applied and adaptive Research to test, validate and release improved techniques of grafting • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments

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; seedling propagation 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 for more research on the technology • 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	<ul style="list-style-type: none"> • Not yet practiced commercially
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Most farmer have not embraced the practice of propagation using grafting • 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 grafting method • Scaling up and promotion of existing nurseries on embracing the management practice
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Raising seedlings through grafting allow farmers to transplant the seedlings and irrigate as they await expected rain therefore spread production
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Channeling of more recourses on the promotion of the technology to create more awareness
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 4,000 per acre

Estimated returns	<ul style="list-style-type: none"> To be established through research
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 Women and youth have limited access to productive resources such as land, credit, and quality seeds than men Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> Employment opportunities exist for youth in production and marketing the produce through ICT
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to productive resources (i.e. land, credit, and quality seeds) than men VMGs have less access to agricultural information, technology and knowledge than men Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> Opportunities exist for unemployed youth in Watermelon production and marketing through ICT Watermelon is nutritious and well adopted in the country hence will act as a food security crop for the VMGs
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> A farmer in Bungoma by name Japhet Wanyonyi has been doing grafting of watermelons using wild melon as a rootstock and uses the improved vine that has just flowered. He says the resultant fruits are bigger and healthier than the ungrafted ones
Application guidelines for users	<ul style="list-style-type: none"> Grafting manual How to produce grafted vegetable plants www.vegetablegrafting.org chapter 3.2.1
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> Requires validation
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403

	MARIGAT
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, Timon Moi (GeRRI), Thomas Chebii, Dr. Lusike Wasilwa (KALRO HQ), David Lelgut (KALRO Muguga North)
Partner organizations	<ul style="list-style-type: none"> • Seed and chemical companies, • Universities other research organizations

2.3 Good Agricultural Practices (Research Gaps) and Food Safety Management Systems

2.3.1. TIMP Name	Hazard Analysis Critical Control Points (HACCP) Plan for Watermelon Value Chain in Kenya
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> • The presence of chemical, biological and physical hazards in the Watermelon 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 Watermelon value chain in Kenya. This ultimately leads to reduced productivity of the active population in the country. • The biological contaminations previously reported on this value chain include presence of <i>Escherichia coli</i> (<i>E. coli</i>), <i>Salmonella</i> spp., <i>Aspergillus flavus</i> and <i>Aspergillus parasiticus</i>. • 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.
What is it? (TIMP description)	<ul style="list-style-type: none"> • Food safety management system (FSMS) through Hazard Analysis and Critical Control Point (HACCP) in Watermelon value chain is a system of food safety monitoring and control based on the

	<p>systematic identification and assessment of various hazards. It is a preventive, rather than a reactive, tool that places the protection of the Watermelon supply from biological, chemical and physical hazards into the hands of food management systems.</p> <ul style="list-style-type: none"> • 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 Watermelon value chain a wholesome and safe Watermelon value chain can be maintained improving on trade and health within and without Kenya borders.
<p>Justification</p>	<ul style="list-style-type: none"> • The only important tool kit to assure food safety through monitoring in the Watermelon 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. • The HACCP approach can be applied to all stages of the Watermelon 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 Watermelon 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. • In this Watermelon 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 Watermelon grain safe for consumption by Kenyans. • 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</p>	

Users of TIMP	<ul style="list-style-type: none"> • Watermelon value chain actors from farmers, traders, food vendors, processors and consumers.
Approaches to be used in dissemination	<ul style="list-style-type: none"> • The National and County level extension service providers • Common Interest Groups discussions • Field days • Exhibitions, • Seminars, meetings and trainings • conferences • Electronic media (radio, TV) • Promotional materials (posters/brochures /leaflets) • Social media (Whats App, Facebook, Twitter). • Phone and online applications • Technology shops • Call-in Q & A centres • 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 watermelon 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 Watermelon value chain actors for implementation in order to reduce hazards. • Applied and adaptive Research to test, validate and release improved Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Access to media, mobile and online tools • Favourable legal and regulatory environments • optimum literacy levels of value chain actors • Sufficient resources at county and national levels for extension and dissemination activities
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • Institutions with IPM and 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

	<ul style="list-style-type: none"> • Universities (Public and Private) • NGOs • Private sector • Processors and local traders • Financial Institutions- e.g. banks and donor communities to provide financial access and inclusion support systems. • Other service provider agencies including micro-finance agencies
C: Current situation and future scaling up	
Counties where already promoted. if any	-
Counties where TIMPs will be up scaled	<ul style="list-style-type: none"> • All counties growing and consuming Watermelon in Kenya.
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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Funding of dissemination platforms • Prepare and package information for dissemination brochures. Upscale the technology at grass root level through FFBS • On-farm demonstrations at strategic places accessible to target farmers • Holding field days/open days • Prepare and package information for dissemination brochures. Upscale 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 up scaling of the technology. • Establish Watermelon innovation platforms
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • The value chain of watermelon nut in Kenya is willing to adopt the HACCP plan if well engaged.

Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> The policies and laws in public health in place in Kenya are supportive to the use of HACCP Plan in watermelon value chain.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> To be determined
Estimated returns	<ul style="list-style-type: none"> To be determined
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 on HACCP 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 led to improved health of the various gender categories due to consumption of clean health watermelons that are free from hazards.
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"> Proper application of HACCP will led to improved health of the various gender categories due to consumption of clean health watermelons that are free from hazards.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> N/A
Application guidelines for users	<ul style="list-style-type: none"> N/A
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> Ready for up scaling;
G: Contacts	

Contacts	Director General, KALRO Dr. Joyce Maling'a – Institute Director, FCRI. Dr. Godwin Macharia - Centre Director, KALRO Njoro
Lead organization and scientists	Mr. John N. Ndung'u, FCRI - KALRO Njoro Mr. Athony Nyaga, KALRO PTC Dr. Francis Wayua, KALRO Kakamega Dr. Lusike Wasilwa, Crops Director, KALRO Headquarters Mrs. Violet Kirigua, KALRO Headquarters Beatrice Wanjiku, KALRO Njoro
Partner organizations	<ul style="list-style-type: none"> • MoALFC, • AFA, • FPEAK, • PCPB, • AAK, • KEPHIS, • County governments, • NGO's • Universities.

2.3.2. TIMPs name	Good Agricultural Practice (GAP) for Watermelon
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> • The presence of chemical residues, biological and physical hazards in the Watermelon 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 directly determine the overall food quality and safety and thus present negative impacts on the economy, health of families, communities and industries subsisting on the Watermelon value chain in Kenya. This ultimately leads to reduced productivity of the active population in the country. • 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>.


	<ul style="list-style-type: none"> 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.
What is it? (TIMP description)	<ul style="list-style-type: none"> 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. 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. It is not about a specific crop production but the process through which production takes.
Justification	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> All Watermelon 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, On-farm demonstrations Field days Agricultural shows Farmer to farmer communication Mass media e.g Mkulima program Seminars, Meetings, trainings Conferences Promotional materials (posters/brochures/leaflets) Farmer Field and Business Schools Agricultural Innovation Platforms

	<ul style="list-style-type: none"> • Mobile phone and online applications • Technology shops • Call-in Q & A centres • 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 Watermelon varieties • A platform for interaction of Watermelon value chain stakeholders
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Producer organizations, NGO's, MoALFC, Private extension providers, CoG and other value chain players, Agro-chemical companies, legal and regulatory agencies
C: Current situation and future scaling up	
Counties where already promoted, if any	-
Counties where TIMP will be up scaled	<ul style="list-style-type: none"> • All counties in Kenya where Watermelon is produced and consumed
Challenges in dissemination	<ul style="list-style-type: none"> • Lack/inadequate knowledge on the benefits Research Gaps • Lack of legislative mechanisms to support the GAP, in particular the domestic scope • The perception that GAP is oppressive rather than supportive • Limited investment in regulatory mechanisms for Research Gaps • Applied and adaptive Research to test, validate and release improved Watermelon varieties • A platform for interaction of Watermelon 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 Watermelon innovation platforms • Involvement of private operators, other government agencies (County, KEPHIS and MoALFC-AFA), Non-governmental agencies, can fast track the up scaling of the technology. • Strengthen legal and regulatory mechanisms and agencies
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • The low number of stakeholders aware of GAP

	<ul style="list-style-type: none"> Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> Supportive policy of national and county governments to promote adaption of GAP's.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> To be determined
Estimated returns	<ul style="list-style-type: none"> To be determined
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 on GAP 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 led to improved health of the various gender categories due to consumption of clean health watermelons that are free from hazards.
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"> Proper application of GAP will led to improved health of the various gender categories due to consumption of clean health watermelons that are free from hazards.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	<ul style="list-style-type: none"> Options for certification exist depending on whether it is a single holder certification or group compliance. Compliance is a process and hence takes time and involves a process of continuous improvement. No need for farm sophistication to adopt. There is provision for taking corrective action for all noncompliance at time of assessment. Requires continuous training and exposure to better systems.

F: Status of TIMP readiness (1. Ready for upselling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling
G: Contacts	
Contacts	Officer in Charge KALRO – PTC, Centre Directors; KALRO FCRI Njoro and KALRO West Pokot; Director General KALRO
Lead organization and scientists	KALRO: Nyaga A., Ndung’u, J., Wayua, F., Wasilwa, L and Kirigua, V.
Partner organizations and their roles	<ul style="list-style-type: none"> • MoALFC, • AFA, • FPEAK, • PCPB, • AAK, • KEPHIS, • County governments, • NGO’s • Universities.

2.4 Agronomic Management Practices


2.4.1 TIMP Name	Land preparation 
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management Practice
A: Description of the technology, innovation or management practice	

Problem to be addressed	Improper land preparation that affects overall crop performance and ultimate product quality and yields
What is it? (TIMP description)	Good land preparation requires that land is ploughed a few weeks before planting. Deep ploughing of up to 20cm is necessary because watermelons is deep rooted. Chisel plough soils with hardpan to improve drainage and root penetration. Using a tractor, ox plough or hand hoeing, makes a uniform flatbed. For irrigation purposes double furrows can be opened up at 5 metres interval (one furrow being a channel for water and the other one planting row). Connecting furrows are the made by hand or tractor to get a plot of 5mx5m.
Justification	Good land preparation enhances weed control, aeration and mixing of organic matter with the soil. Adequate land preparation also ensures increased water infiltration. Multiple plowing prior to sowing is also a good weed control measure and may therefore prevent weeds from competing with the watermelon crop. The competition is is undesirable because it results in significant yield loses.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Call-in Q & A centres
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Awareness of challenges of poor land preparation in the field.

	<ul style="list-style-type: none"> • 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"> • MoALF will work with the farmers to provide technical extension services and ensure favourable legal and regulatory environments • 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	<ul style="list-style-type: none"> • Kenyan ASALs (Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir)
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • 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 learned in up scaling, if any	<ul style="list-style-type: none"> • Optimum yields obtained
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive sustainable land preparation methods are encouraged by the government. • Capacity building of all stakeholders in the value chain is an ongoing endeavor in all levels of government • 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	<ul style="list-style-type: none"> The main input cost is the labour for <i>land</i> preparation. The cost will depend on the land size, labor costs and the landscape terrain/slope /soil type/tractor driven plough however basic cost ranges from ksh 3000 to 4,000 per acre
Estimated returns	<ul style="list-style-type: none"> Unknown but contribute towards increased yield along with other agronomical practices jointly; but on average Ksh. 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women have less access to farm implement used for land preparation than men Women and youth have limited access to productive resources such as land, credit, and then men Women 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"> Opportunities for women to develop various products from the crop Youth have opportunities in marketing the crop through ICT
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have less access to farm implements used for land preparation than men 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 seed and information on new varieties and production techniques There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> Opportunities exist for VMGs in marketing quality seed
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Watermelon Production Manual
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires	<ul style="list-style-type: none"> Ready for up scaling.

validation; 3. Requires further research)	
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat.
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut.
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

2.4.2 TIMP Name	<p>Crop Spacing</p>  <p>Source: jica.go.jp</p>
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	<p>Incorrect plant spacing which impacts on the optimum plant population and the resulting product yield and quality. A sparsely planted crop even with ideal management results in lower total fruit yield compared to a correctly spaced crop. Likewise if a crop is planted too closely, there will be intense competition between plants that will result in formation of</p>

	<p>smaller and mishapen fruits resulting in lower total yield and quality. In addition, crowded plants are difficult to receive uniform protective chemicals and therefore unsprayed plants are likely to be reservoirs for prsts and diseases</p>
What is it? (TIMP description)	<p>It is a management practice where the distance from one plant to another and one plant row to another are determined respectively. It is aimed at attaining optimum plant population per given area.</p> <p>Production of optimum yields of watermelon through correct spacing management.</p>
Justification	<p>Improper spacing management practices have contributed to low yields due to low/high crop density</p> <p>Challenges of field pests and diseases are greatly a result of too bushy crop due to over-population.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Call-in Q & A centres
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Increasing productivity per unit • Efficient pest and disease management • Type and performance potential of the variety • Mode/channel of dissemination selected • Cost of the management practice

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	<ul style="list-style-type: none"> • Kenyan ASALs (Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir)
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • 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 learned in up scaling, if any	<ul style="list-style-type: none"> •
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive sustainable land preparation methods are encouraged by the government. • • Capacity building of all stakeholders in the value chain is an ongoing endeavor in all levels of government • 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	<ul style="list-style-type: none"> • KES 2,000 per acre
Estimated returns	<ul style="list-style-type: none"> • 150,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to farm implement than men • Women and youth have limited access to productive resources such as land, credit, and then men

	<ul style="list-style-type: none"> • Women 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"> • Opportunities for women to develop various products from the crop • Youth have opportunities in marketing the crop through ICT
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to farm implements than men • 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 seed and information on new varieties and production techniques • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs in marketing quality seed
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional high value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> • Flat beds of 2 m wide are raised to 20 to 30 cm height and seed sown at the rate of 16-25 seeds per m² at 1.2 cm to 1.9 cm depth. • Land should be ploughed and harrowed well and levelled on the surface for easy establishment of crop. • Use certified seed from known seed merchants
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p>

Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut.
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

2.4.3 TIMP Name	Watermelon pollination
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low fruiting due to poor pollination attributed to heaviness of watermelon pollen hence cannot be carried by wind
What is it? (TIMP description)	This is the introduction of bee colonies in watermelon field to improve pollination. The approach used is integrating bee hives within the watermelon field to enhance pollination.
Justification	Honey bees play a key role in their pollination hence improve productivity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets)

	<ul style="list-style-type: none"> • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Call-in Q & A centres
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	<ul style="list-style-type: none"> • Kenyan ASALs (Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir)
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Harnessing bees may be a challenge in some parts of the farmer's farm especially where humans verses the bee may conflict.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Information packaging and dissemination in brochures • Scaling up participation of end-user in technology development, FFS
Lessons learned in up scaling, if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Bees contribute to improved pollination of not only watermelon but also other crops hence contributing to environmental diversity
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Not yet established
Estimated returns	<ul style="list-style-type: none"> • To be established through further research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to farm implements used for land preparation than men • Women and youth have limited access to productive resources such as land, credit, and then men

	<ul style="list-style-type: none"> • Women have limited access to education, training and extension services than men • Women have less access to agricultural information, technology and knowledge • Men dominate most decisions at the household and community levels
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth in bee keeping • Youth have opportunities in marketing the crop through ICT
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 hives • 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 seed and information on new varieties and production techniques • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for VMGs in marketing honey, and honey products while at the same time venturing in the commercial production of watermelons • Opportunities exist for youths and those recovering from drugs in bee keeping
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • High demand of watermelon due to nutritional value in other parts of Kenya.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon Production Manual
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Require validation
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat.
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut.
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments

	<ul style="list-style-type: none"> • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations
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Research Gaps

1. Comparative studies on the performance of watermelon under natural pollination conditions and in integrated bee-hive set-up.
2. Studies on the influence of Mango flowering on watermelon production (comparative bee visitation studies)

2.4.4 TIMP Name	Crop rotation
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low watermelon yields occasioned by severe pest and disease infestation as a result of their build up in the field when the crop is grown in the same field for several seasons.
What is it? (TIMP description)	<p>Crop rotation is the technique of planting crops in a different area of the garden so that no single crop will be planted in the same place two—or more—years in a row.</p> <p>It's a practice of growing different types of crops (or none at all) in the same area over a sequence of seasons.</p> <p>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 follow one another to avoid pest and diseases build up.</p>
Justification	Changing crops routinely allows the land to remain fertile, since not all of the same nutrients are being used each season. In fact, crop rotation can help to manage your soil fertility, reduce soil erosion, improve your soil health and increase nutrients availability to plants. For example, planting a legume, such as soybeans, helps to replenish necessary nitrogen in the soil. When a different crop is planted, it breaks the life cycles of pest

	and diseases specific to the previous crop and therefore avoiding their build up in the field.
Region promoted	<ul style="list-style-type: none"> • Baringo county
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Call-in Q & A centres
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Sufficient land resource to permit rotation • Farmers knowledge and willingness for adopting suitable rotation crop • Increasing productivity per unit • Efficient pest and disease management • Farmers tour for knowledge from Other successful farmers
Partners/stakeholders for scaling up	<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.

	<ul style="list-style-type: none"> • 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 can be up-scaled	<ul style="list-style-type: none"> • West pokot 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"> • Strengthen dissemination channels • Strengthen national and county government collaboration • Simplify extension and dissemination materials • Use easily accessible channels
Lessons learned in upscaling	<ul style="list-style-type: none"> • Availability of Cost benefit information that can attract farmers to engage into the activities.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive sustainable land preparation methods are encouraged by the government. • Capacity building of all stakeholders in the value chain is an ongoing endeavor in all levels of government • Understanding the physical and biotic environment in target ecologies • Economically viable rotation crops that also meet community and cultural preferences, and practices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • Unknown
Estimated returns	<ul style="list-style-type: none"> • Its yet to determined
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women perform most of the weeding activities therefore the reduced weeds due to crop rotation reduces 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"> • Opportunities for women exist to perform other activities due to their reduced workload through weeding.
VMG issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to education, training and extension services. • VMGs have less access to credit • 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 VMGs to access credit through affirmative avtion funds. • Increased production will improve food and nutrition security and economic empowerment of VMGs.
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • Watermelon plant should be rotated with other crops not related to the curcubitacea family
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon brochures, fliers, modules and manuals
F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	<ul style="list-style-type: none"> • Ready for up-scaling
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat.
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut.
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

2.4.5 TIMP Name	Weed management 
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Improper weed control has the potential of allowing the build up of noxious weeds that can cause serious yield and subsequent economic losses. Weeds compete for nutrients, water, and light. In addition weed foliage prevents full coverage of fungicides and insecticides during spraying. That will facilitate build up of pests and diseases. Weed leaves also slow harvesting and create imprint/defects that reduces quality of fruits.
What is it? (TIMP description)	Weed control is done by mechanical removal, chemical suppression where possible and even using mulching materials such as polyethylene sheets. Mechanical removal is mostly used and is one of the effective control for weeds used by small to medium scale farmers.
Justification	Mechanical removal of weeds is the most management practice used because watermelon plants are very susceptible to herbicide damage. This especially true during the early seedling stages. The weeding cultivation process between rows should be shallow to avoid injury to the plant root systems.
Region promoted	<ul style="list-style-type: none"> • All counties growing watermelons
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers

	<ul style="list-style-type: none"> Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> On-farm demonstrations Field-days Agricultural shows and exhibitions MoALFC/Extension officers Farmer to farmer communication Mass media – “Mkulima program” Seminars, Meetings, trainings Conferences Promotional materials (posters/brochures/leaflets) Farmer Field and Business Schools Agricultural Innovation Platforms Mobile phone and online applications Call-in Q & A centres
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Knowledge of critical stages Favourable environment for farmers to Learn from Others Commitment to the enterprise by farmers
Partners/stakeholders for scaling up	<ul style="list-style-type: none"> MoALF will work with the farmers to provide technical extension services and ensure favourable legal and regulatory environments 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	<ul style="list-style-type: none"> Machakos, Kirinyaga, Nyeri, Meru, Isiolo, Garissa, Baringo and Elgeyo marakwet counties and also the coastal counties
Counties where TIMPs can be up-scaled	<ul style="list-style-type: none"> West pokot 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"> • Strengthen dissemination channels • Strengthen national and county government collaboration • Simplify extension and dissemination materials • Use easily accessible channels
Lessons learned in upscaling	<ul style="list-style-type: none"> •
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive sustainable land preparation methods are encouraged by the government. • Capacity building of all stakeholders in the value chain is an ongoing endeavor in all levels of government • Understanding the physical and biotic environment in target ecologies • Economically viable rotation crops that also meet community and cultural preferences, and practices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KEs. 4,000 per acre
Estimated returns	<ul style="list-style-type: none"> • To be established through further research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the weeding activities therefore this may be a burden for them • Women have less access to implements used for mechanical weed control than men • 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 • 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 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

	<ul style="list-style-type: none"> • Due to their social status VMGs are often excluded from decision making in development and dissemination activities
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth exists in weeding
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • Machakos, Kirinyaga, Nyeri, Meru, Isiolo, Garissa and Elgeyo marakwet counties and also the coastal counties
Application guidelines for users	<ul style="list-style-type: none"> • Watermelons brochures, fliers, modules and manuals
F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	<ul style="list-style-type: none"> • Ready for up-scaling
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat.
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut.
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

2.4.6 TIMP Name	Plant Pruning
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Watermelon plants that have received adequate fertilizer tend to grow excessive foliage, vegetation and many lateral branches. Plants with excessive vegetation may produce

	many but smaller and low quality fruits. The plants are also bushy and pose challenges in pest and diseases control.
What is it? (TIMP description)	<p>It is a management practice where the number of running vines are restricted to two to three and also limiting the number of subsequent lateral branches. It is aimed at reducing the number of bearing vines in order to maximize on the size and quality of fruits produced.</p> <p>Farmers should aim at 4 to 6 fruits per plant to ensure large fruits often demanded by the market.</p> <p>This can be achieved by restricting the number of fruits per lateral branch to 1 or 2 depending on the health of the plant.</p>
Justification	<p>Excess main running branches result in small and low quality fruits.</p> <p>Field pests and diseases may pose a problem because of a bushy crop.</p> <p>Extra vines result in competition for nutrients and hence light and low quality fruits</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Call-in Q & A centres
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Farmers knowledge and willingness for adopting pruning technology. • Increasing productivity per unit • Efficient pest and disease management

	<ul style="list-style-type: none"> • Farmers tour for knowledge from Other successful farmers • Efficient use of fertilizer
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	<ul style="list-style-type: none"> • Kenyan ASALs (Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir)
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Farmers' perception that pruning results in crop damage
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 • Practical field demonstrations
Lessons learned in up scaling, if any	
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive sustainable land preparation methods are encouraged by the government. • Capacity building of all stakeholders in the value chain is an ongoing endeavor in all levels of government • Understanding the physical and biotic environment in target ecologies • Economically viable rotation crops that also meet community and cultural preferences, and practices • Opportunities for increased yields due to reduced nutrient competition
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	<ul style="list-style-type: none"> • KES 2,000
Estimated returns	<ul style="list-style-type: none"> • Can be established by Research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women have less access to information, technology and knowledge • Women have less access to land that can be used for watermelon farming than men • Women and youth have limited access to education, training and extension services than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth employment in pruning
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to agricultural information, technology and knowledge • VMGs have limited access to productive resources such as land, credit, and quality seed • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities exist for youth and those recovering from drugs in pruning
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • Generally farmers practicing vine pruning harvest heavier and fully formed fruits.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon Production Manual and Fact sheets
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling • Requires research to establish actual return attributed to pruning
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat.
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut.
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments

	<ul style="list-style-type: none"> • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations
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2.4.7 TIMP Name	Plant Training
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	In a well-managed Watermelon field, plants can produce long and wildly spreading vines that grow and overflow across paths and irrigation channels. Such wild spreading plants are trampled on or crushed by machinery during agronomic management operations. As a result the plants are damaged or get infected with diseases
What is it? (TIMP description)	It is a management practice where the two running vines and associated lateral branches are directed to grow in a direction away from the paths and irrigation channels. If under a trellis system, the two to three running vines and associated lateral branches are directed to grow along the trellises.
Justification	It reduces any mechanical damages to those plants that overflow into paths and tracks caused by machineries and people stepping on them. Leading the plants away from irrigation channels reduces incidences of fungal, bacterial and viral diseases. The training exercises results in cleaner fruits
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, • Traders, • Seed Dealers, • Researchers, • Consumers • Extension service providers • Processors

Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm demonstrations • Field-days • Agricultural shows and exhibitions • MoALFC/Extension officers • Farmer to farmer communication • Mass media – “Mkulima program” • Seminars, Meetings, trainings • Conferences • Promotional materials (posters/brochures/leaflets) • Farmer Field and Business Schools • Agricultural Innovation Platforms • Mobile phone and online applications • Call-in Q & A centres
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Farmers knowledge and willingness for adopting pruning technology. • Increasing productivity per unit • Efficient pest and disease management • Farmers tour for knowledge from Other successful farmers • Efficient use of fertilizer
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> • MoALFC will work with the farmers to provide technical extension services. • Counties facilitate the extension and other support such as transport to the staff as well as being a channel for provision of grants to the farmers. • CIGs play the role of adoption of the technologies through their various groups. • VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.
C: Current situation and future scaling up	
Counties where already promoted. if any	<ul style="list-style-type: none"> • Kenyan ASALs (Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir)
Counties where TIMPs will be upscaled	<ul style="list-style-type: none"> • West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Low uptake before the farmers see results • Farmers’ perception that training is laborious and results in crop damage
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 • Practical field demonstrations

Lessons learned in up scaling, if any	
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Watermelon is widely grown and consumed in the country and thus it is socially acceptable. • The policy environment is conducive sustainable land preparation methods are encouraged by the government. • Capacity building of all stakeholders in the value chain is an ongoing endeavor in all levels of government • Understanding the physical and biotic environment in target ecologies • Economically viable rotation crops that also meet community and cultural preferences, and practices • Opportunities for increased yields due to reduced nutrient competition
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • KES 6,000
Estimated returns	<ul style="list-style-type: none"> • Can be established by Research
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women have limited access to productive resources such as land and credit than men • Women 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"> • Opportunities for attending trainings exist for the youths
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
VMG related opportunities	<ul style="list-style-type: none"> • Opportunities for attending trainings exist for youth and those recovering from drugs
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> • Generally farmers practicing vine training harvest heavier, cleaner and fully formed fruits.
Application guidelines for users	<ul style="list-style-type: none"> • Watermelon Production Manual

F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling • Requires research to establish actual return attributed to training
G: Contacts	
Contacts	Centre Director KALRO-Perkerra P.O. Box 32-30403 Marigat.
Lead organization and scientists	KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut.
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture Livestock and Fisheries • County Governments • Local and International Seed & chemical companies • Universities • Farmer organizations • Faith based organizations

2.5 Soil Fertility Management

2.5.1 TIMP name	Integrated manure management (IMM)
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields caused by land degradation characterized by the declining soil fertility, soil moisture stress, increased soil erosion and poor soil health. Well managed manure will supply macro and micro nutrients for enhanced crop production. GHG emissions, caused by poor manure management and handling leading Environment protection by minimizing leaching of nutrients
What is it? (TIMP description)	Manure Management is the optimal, site-specific handling of livestock manure from collection, through treatment and storage up to application to crops (and aquaculture). Manure can be in solid or liquid form, and is often mixed with crop residues and composted to enable decomposition. Proper manure management reduces emission of methane and carbon dioxide.
Justification	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 22 kg/ha for nitrogen, 2.5 kg/ha for phosphorous, and 15 kg/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. 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 and biodiversity. Given the acute poverty and limited access to mineral fertilizers, manure has the potential of providing the limiting nutrients and improving the soil health.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Researchers, Extension agents, county government, NGOs
Approaches to be used in dissemination	Open and field days Exchange visits Demonstration farms
Critical/essential factors for successful promotion	Training on feeding, management and use of manure Dissemination approach used to reach target farmers Model demonstration plots using vegetables
Partners/stakeholders for scaling up and their roles	County governments, Provide extension services, farmer mobilization and policy formulation ILRI, technical backstopping NGOs – micro financing services
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
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 plots by counties • Capacity building of farming and 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 learned 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 for development and upscaling	<p>Social: Acceptability of manure as a resource for increasing agricultural productivity in pastoral communities</p> <p>Environment: Knowledge and awareness creation on pathogens which can be harbored in the manure leading to disease outbreaks to livestock</p> <p>Knowledge and awareness creation to reduce risk of propagation of invasive species when the seed is ingested by the animal and passed to crop field</p> <p>Contamination of water sources by leaching of nutrients</p> <p>Markets: Availability of markets and better prices as MM would result in increased output and quality</p> <p>Policy: Policies that address manure management in relation to pathogens and environment (e.g. leaching, GHG emissions)</p>

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	About 20 t ha ⁻¹ of well managed manure will need to be applied. This would cost approximately 40,000/=;
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 handling and application hence may not be adopted by women who are already overburdened. • Women and youth have limited access to land for watermelon cultivation than men. • Women and youth may also have limited access to inputs such as manures than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> • Opportunity exist for women to access the required credit through the women enterprise funds.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation than men. • VMGs may also have limited access to finances to buy the required inputs such as manures than men. • Women 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 to VMGs. • Increased production due to use of manure will lead to increased consumption and utilization of Watermelon and hence improved health of VMGs.
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	<p>The guideline focus on the following areas:-</p> <p>Animal feeds: Feeding livestock with quality materials e.g. high protein concentrates will result in manures with a higher nitrogen content</p> <p>Livestock housing and manure collection</p> <p>Manure storage to preserve nutrient and avoid loses by covering to minimize losses through volatilization</p> <p>Timing of application for maximum utilization by the crop</p> <p>Installing anaerobic digestion for biogas production</p> <p>Regular analysis of manure to ascertain the quality</p> <p>Manure/Composts take a long time to cure, allow 2-3 months.</p>
F: Status of TIMP readiness (Ready for up-scaling; Requires validation; Requires further research)	Requires validation
G: Contacts	

Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization and scientists	KALRO, Esilaba A.O., Odhiambo H., Otipa M. J., Orayo M., Masinde A. A.O., Ndungu B. W., Muriuki S. K., Ochieng V., Nasirembe W., Ndubi J., Ndambuki, J. and Kimani, S.K.
Partner organizations	County government, Private Public Partnerships

Research Gaps

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

2.5.2. TIMP name	Integrated Soil Fertility Management (ISFM)
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields due to declining soil fertility, low organic matter, poor soil structure and low available moisture due to poor water holding capacity.
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	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. 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. 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.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension officer, County government

Approaches to be used in dissemination	<ul style="list-style-type: none"> • Training in workshops • On-farm visits • Farmer field schools (FFS) • On-farm demonstrations (during FFS)
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. • Knowledge about manure combination with modest amounts of inorganic fertilisers.
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	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
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 • Training on combining manures with mineral fertilisers.
Lessons learned if any	<ul style="list-style-type: none"> • For ISFM to succeed, good germplasm/seed/seedlings, etc 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	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"> • It is labour intensive hence may not be adopted by women who are already overburdened • Women and youth have limited access to credit to purchase the required inputs such as such as fertilizers than men

	<ul style="list-style-type: none"> • Women and youth have limited access to land for Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	<ul style="list-style-type: none"> • Opportunity exist for women to access the required credit through the women enterprise funds.
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation than men. • VMGs have less access to agricultural information, technology and knowledge than men. • It is labour intensive hence may not be adopted by some VMGs who are elderly. • Women and youth have limited access to credit to purchase the required inputs such as such as fertilizers than men.
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 due to use of the TIMP will lead to increased consumption and utilization of Watermelons and hence improved health of VMGs.
E: Case studies/profiles of success stories	
Success stories	ISFM successes have been reported in sorghum and millet value chains in Machakos where productivity have been improved.
Application guidelines for users	<p>Always use well-adapted, disease- and pest-resistant germplasm/seed to make efficient use of available nutrients.</p> <p>Ensure that good agronomic practices are upheld</p> <p>For sustainability, lone use of inorganic or organic materials should be avoided.</p>
F: Status of TIMP readiness (Ready for up-scaling; Requires validation; Requires further research)	Requires validation
G: Contacts	
Contacts	Centre Director, KALRO Kabete
Lead organization and scientists	KALRO scientists: ; E. Gikonyo, C. Kibunja, A. Muriuki, D. Kamau, A. Esilaba, J. Ndufa, C. Kundu and S. Kimani, Odhiambo H.,Orayo M., Otipa M. J., Masinde A. A.O., Ndungu B. W., Muriuki S. K., Ochieng V., Nasirembe W., Ndubi J., Ndambuki, J.
Partner organizations	County governments 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. TIMP name	
Rapid soil testing services	
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Risk of low yields due to inappropriate soil management practices, arising from lack of/untimely availability of soil analytical data for fertilizer recommendation.
What is it? (TIMP description)	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. It requires partners involved (ICRAF, ISDA and SoilCares) to work closely with KALRO and County agricultural officers to sensitize farmers to embrace the testing method.
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 • Publicity campaigns done at County levels.
Critical/essential factors for successful promotion.	<p>Availability of the necessary equipment for rapid on the spot soil testing.</p> <p>Established rapport between farmers and the technical personnel involved in soil testing.</p> <p>Adequate qualified staff to cover the large number of samples from the target 24 counties before the planting season begins.</p> <p>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.</p> <p>Farmers must understand, trust, and be willing to act upon the information provided.</p>
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	Baringo
Counties where TIMP will be up-scaled	All other Counties with suitable agro-ecological settings for Watermelon production.
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 learned in up-scaling 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 Boron.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Socially acceptable-brings income, increases food production, nutrition security and family cohesion. • Environmentally friendly; -Recommendations provided ensures that farmers only apply the required amounts of fertilizers. No excess nutrients to contaminate ground and surface water. • Market will absorb the increased productivity • Supporting frameworks/policies are available. • Training of personnel at national and County levels.
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 Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> • Offers employment opportunity especially for the youths who can be trained on soil sampling to help the local community in soil sampling. • Retooling of personnel at national and County levels by bringing services closer to the users will save time for the various gender categories especially women so that they can perform other activities
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
VMG related opportunities	<ul style="list-style-type: none"> • Offers employment opportunity to some VMGs especially the youths who can be trained on soil sampling to help the local community in soil sampling. • This is a TIMP that will bring soil testing services nearer to the VMGs therefore saving their time in addition to improving their productivity.
E: Case studies/profiles of success stories	

Success stories	Has been tested used successfully by other organizations like ICRAF, Soil Cares & 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 up scaling; Requires validation; Requires further research)	Requires validation
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO secretariat
Lead organization and scientists	KALRO, C. Kibunja, E. Gikonyo, Christy van Beek, A. Sila, D. Kamau, A. Esilaba, C. Kundu and S. Kimani., Odhiambo H., Otipa M. J., Masinde A. A.O., Ndungu B. W., Muriuki S. K., Ochieng V., Nasirembe W., Ndubi J., Ndambuki, J.
Partner organizations	<i>County governments in the 24 counties, Soil Cares, ICRAF and iSDA</i>

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.

2.5.4 TIMP Name	Low-Cost Composting
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop productivity resulting from soil fertility decline manifested by low levels of organic carbon, macro and micro nutrients. Degraded soils have poor soil structure and low water holding capacity.
What is it? (TIMP description)	Composting is the biological decomposition of organic waste such as food or plant material by bacteria, fungi, worms and other organisms under controlled aerobic conditions resulting in an accumulation of partially decayed organic matter called humus. Composting is thus one of the most effective process for recycling organic wastes intended for use in agriculture
Justification	The decline in soil fertility in smallholder system is a major factor inhibiting agricultural development on farms. It is estimated that soils are being depleted at annual rate of 22 kg/ha for nitrogen, 2.5 kg/ha for phosphorus, and 15 kg/ha for potassium. Compost contain the nutrients nitrogen, phosphorus and potassium that are found in most chemical fertilizer and even secondary and trace elements (such as zinc, iron and magnesium) that are not, and which are useful to the roots of growing plants. The compost also adds balanced nutrients to soil in an easily assimilated form, and helps improving soil structure by lightening heavy clays and improving water retention properties in porous sands.
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"> • Open and field days • Exchange visits • Demonstration farms • Mass and social media
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Training on different composting techniques and use • 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 government extension services - Provide link with farmers. • Community farmer groups - play coordination role for ease in problem identification and dissemination • ILRI - technical backstopping • NGOs – micro financing services
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	All other counties with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of model demonstration farms • Lack of continuity in training of extension and farmers in composting skill • Lack of proper mobilization mechanism for reaching many farmers

Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establishment of many demonstration plots by counties • Capacity building of smallholder farmers on composting management and its benefit • Continuous capacity building of demonstration farmers and extension workers • Use of approaches to mobilize farmer to attend demonstration forums
Lessons learned if any	<ul style="list-style-type: none"> • Proper use of composts to improve soil fertility • Use of composts to enhance crop productivity • Skills in composting methodologies and minimizing health risks associated with composts making
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • The TIMP will be socially acceptable to the users • Composting requires care when handling wastes that would normally contain heavy loads of pathogens and aim at removing non-biodegradable and hazardous waste and controlling odours and flies. Also compost pits if not well managed can also be a source of contamination by leaching of nutrients. • That there will be an available market for the compost makers. • There will be policies developed to promote composting and combine the composts with modest amounts of mineral fertilizers for vegetable production.
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 Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> • Offers employment opportunity especially for the youths who can be trained on soil sampling to help the local community in soil sampling. • Retooling of personnel at national and County levels • By bringing services closer to the users will save time for the various gender categories especially women so that they can perform other activities.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
VMG related opportunities	<ul style="list-style-type: none"> • Offers employment opportunity to some VMGs especially the youths who can be trained on soil sampling to help the local community in soil sampling. • This is a TIMP that will bring soil testing services nearer to the VMGs therefore, saving their time in addition to improving their productivity.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	The guidelines for users focus on the following areas:-

	<ul style="list-style-type: none"> • Need to mix the compost with the soil to ensure adequate nutrition in the rooting zone. • Compost storage to preserve nutrient and avoid losses. • Timing of application for maximum utilization by the crop. • Regular analysis of compost to ascertain the quality including contaminants like heavy metals and pathogens. • Type of composts and quality that will determine the application rates. • Materials that cannot be used for composts include, charcoal ashes, dog/cat manure, meat/animal fat, leaves or biomass from certain tree species that have toxic levels for microbes, e.g. eucalypts and cassia spp. <p>Reference Karanja NK, Kwach HO, Njenga M (2005). Low cost composting training manual. Techniques based on the UN Habitat urban harvest CIP community based waste management initiative.</p>
F: Status of TIMP readiness (1=Ready for up-scaling; 2=Requires validation; 3=Requires further research)	2- Requires validation
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization and scientists	KALRO, S. Kimani, B. Mugo, E.Mutuma, D. Kamau, M. Okoti, J. Wamuongo, A.O. Esilaba., Odhiambo H., Otipa M. J., Masinde A. A.O., Ndungu B. W., Muriuki S. K., Ochieng V., Nasirembe W., Ndubi J., Ndambuki, J.
Partner organizations	County government, NGO's

Research Gaps

- Promote composting technology in counties that have not practiced it.
- Conduct nutrient budget study on selected farms using composts in the 24 Counties.

2.6 Soil And Water Management

2.6.1 TIMP name	Contour bunds
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields arising from the risk of soil erosion and increased run off; low soil water retention capacity in most soils.
What is it? (TIMP description)	Contour bunds are stone or earthen walls built across a slope to prevent runoff. 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 cereal crops requiring less water, such as sorghum or millet, can be planted on the ridges.
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"> • 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.
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 the management practice.
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
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

	<ul style="list-style-type: none"> Fast-track land registration.
Lessons learned, if any	<ul style="list-style-type: none"> Contours are largely popular due 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 practice, many of them would be willing to invest.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> Socially acceptable practice but needs awareness creation on its importance Current national policies on soil and water conservation need to be enforced at the County level Require policies that support individual land tenure systems
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"> 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 Watermelon cultivation than men. Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> Opportunities for youths males employment exist in the task of contour bunds.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to land for Watermelon cultivation 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"> Opportunities for youths males employment exist in the task of contour bunds.
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,	Ready for up-scaling

Requires validation; Requires further research)	
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaure; D. Kamau and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

Research Gaps for further research

- 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 TIMP name	Zai pits
Category (i.e. technology, innovation or management practice)	Management Practice 
<i>Zai pits combined with stone rows</i> (Source: KALRO)	
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields arising from the risk of insufficient water to sustain watermelon production due to high seasonal rainfall variability leading to total crop failures.
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> management practice has the potential to harvest and store rain water for prolonged crop use. This management practice 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, extension officers, Farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • 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.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour since the application of this management practice is labour intensive. • Farmers and extension service providers with skills to design and construct contour bunds. • Land tenure systems that allow 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	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • 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 <i>Zai</i> pits for efficiency and increased output per man hour. • Advocating for individual land ownership and training youthful farmers to be champions of <i>Zai</i> pits construction at the Ward level/village level.
Lessons learned, if any	<ul style="list-style-type: none"> • The management practice has huge potential to increase farmers' resilience especially in ASALs. • When the farmers are adequately trained and sensitized, 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 among farming communities on the importance of soil and water conservation • Provision of low-cost TIMPs for soil and water conservation • Enforcement of policies that support individual land tenure systems • Current national policies on soil and water conservation need to be enforced at the County level
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"> • 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 Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for youths males employment exist in the task of making <i>Zai</i> pits.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation 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"> • Opportunities for youths males employment exist in the task of making <i>Zai</i> pits.
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"> • <i>Zai</i> 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 <i>Zai</i> 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 between 60 and 100 cm. • 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 watermelon seeds.

F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	Ready for up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau, Orayo M., Odhiambo H. and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities


Research Gaps for further research

- Conduct trade off analysis (economic analysis) of *Zai* pits as a soil and water management practice in the various AEZs supporting Watermelon production.
- Develop low-cost mechanized tools to ease labor demands in contour construction and maintenance

2.6.3 TIMP name	Bench Terraces
Category (i.e. technology, innovation or management practice)	Management Practice 
(Source: KALRO)	
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields arising from the risk of soil erosion and increased run off; low soil water retention capacity in most soils
What is it? (TIMP description)	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). 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.
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.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers and Extension officers


Approaches to be used in dissemination	<ul style="list-style-type: none"> • 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.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour since the management practice 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 and capacity building • Community farmer groups – Provide on farm demonstration plots to hold Farmer Field Schools. • External service providers – capacity building and access to the management practice.
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
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 terraces construction at the Ward level/village level. • Training on site specific designs and construction of terraces • Fast-track land registration.
Lessons learned, 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"> • The management practice is socially acceptable but needs awareness creation on its importance • Current national policies on soil and water conservation need to be enforced at the County level. • Policies that support individual land tenure systems should be enforced
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"> • 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 Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> • Opportunities for male youth employment exist in performing the task of bench terraces.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation 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"> • Opportunities for male youths employment exist in the task of bench terraces.
E: Case studies/profiles of success stories	
Success stories, if any	-
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 (flatpart) is determined by soil depth, crop requirements, and tools to be used for cultivation. • Optimum width of terrace benches ranges from 2.5 to 5m 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 up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau, Orayo M., Odhiambo H. and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

2.6.4 TIMP name	
<i>Fanya Juu Terraces</i>	
Category (i.e. technology, innovation or management practice)	Management Practice  <p>(Source: KALRO)</p>
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields arising from the risk of soil erosion and increased run off; low soil water retention capacity in most soils.
What is it? (TIMP description)	<i>Fanya juu</i> ’ terraces (juu is Swahili word loosely translated as ‘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. The embankments are usually stabilized with fodder grasses. Crops, such as watermelon may then be grown in the ditches. Through gradual redistribution of soils within the field, the terraces level off. 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.
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. 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 and Extension officers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • 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.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour since the management practice 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 and capacity building • Community farmer groups – Provide on farm demonstration plots to hold Farmer Field Schools. • External service providers – capacity building and access to the management practice.
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
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 terraces construction at the Ward level/village level. • Training on site specific designs and construction of terraces • Fast-track land registration.
Lessons learned, 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"> • The management practice is socially acceptable but needs awareness creation on its importance • Current national policies on soil and water conservation need to be enforced at the County level. • Policies that support individual land tenure systems should be enforced
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"> • 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 Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.


Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for male youths and men exist in performing the task.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation 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"> • Employment opportunities for male youths and men exist in performing the task.
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 up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau, Orayo M., Odhiambo H. and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

2.6.5 TIMP name	Stone Lines
Category (i.e. technology, innovation or management practice)	<p>Management Practice</p>  <p>(Source: KALRO)</p>

A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields arising from the risk of soil erosion and increased run off; low soil water retention capacity in most soils.
What is it? (TIMP description)	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	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 and Extension officers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • 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.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of labour since the management practice 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 and capacity building • Community farmer groups – Provide on farm demonstration plots to hold Farmer Field Schools. • External service providers – capacity building and access to the management practice.
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
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.


	<ul style="list-style-type: none"> • Training youthful farmers to be champions of terraces construction at the Ward level/village level. • Training on site specific designs and construction of terraces • Fast-track land registration.
Lessons learned, 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"> • The management practice is socially acceptable but needs awareness creation on its importance • Current national policies on soil and water conservation need to be enforced at the County level. • Policies that support individual land tenure systems should be enforced
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"> • 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 Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for the various gender categories i.e. youth women and men performing the task.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation 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"> • Employment opportunities for youths exist in performing the task.
E: Case studies/profiles of success stories	
Success stories, if any	In Burkina Faso farmers have reported doubled cereal production when stone lines are used in combination with greater use of compost as fertilizer. https://www.rural21.com/fileadmin/migrated/content/uploads/Stone_lines_against_desertification_0.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 up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M, Wairimu; P. Kitiem, J. Mwaura; D. Kamau, Orayo M., Odhiambo H. and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

2.6.6 TIMP name	Retention Ditches
Category (i.e. technology, innovation or management practice)	Management practice  <p>(Source: KALRO)</p>
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields arising from the risk of soil erosion and increased run off; low soil water retention capacity in most soils.
What is it? (TIMP description)	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	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 and Extension officers

Approaches to be used in dissemination	<ul style="list-style-type: none"> 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.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Availability of labour since the management practice 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 and capacity building Community farmer groups – Provide on farm demonstration plots to hold Farmer Field Schools. External service providers – capacity building and access to the management practice.
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
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 equipment for preparation of terraces for efficiency and increased output per man hour. Training youthful farmers to be champions of retention ditch construction at the Ward level/village level. Training on site specific designs and construction of retention ditches Fast-track land registration.
Lessons learned, 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"> The management practice is socially acceptable but needs awareness creation on its importance Current national policies on soil and water conservation need to be enforced at the County level. Policies that support individual land tenure systems should be enforced
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"> • 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 Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men. •
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for the various gender categories i.e. youth women and men performing the task.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation 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"> • Employment opportunities for youths exist in performing the task.
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 up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau, Orayo M., Odhiambo H. and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

2.6.7 TIMP name	
Grass Strips	
Category (i.e. technology, innovation or management practice)	Management Practice  <p>(Source: KALRO)</p>
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields arising from the risk of soil erosion and increased run off; low soil water retention capacity in most soils.
What is it? (TIMP description)	Grass strips are dense strips of grass planted up to a meter wide, along a contour. With time, silt builds up above the strip and benches are formed. Grass strips can be planted along ditches to stabilize them, or on the rises of bench terraces to prevent erosion. They are a popular and easy way to terrace land, especially in areas with relatively good rainfall. The management practice is suitable in regions with fairly gentle slopes (0 - 6%); grass is needed for fodder; and high rainfall areas.
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. 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 and Extension officers
Approaches to be used in dissemination	<ul style="list-style-type: none"> 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.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Availability of labour since the management practice is labour intensive. Farmers and extension service with skills to design and construct grass strips. 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 and capacity building Community farmer groups – Provide on farm demonstration plots to hold Farmer Field Schools. External service providers – capacity building and access to the management practice.
C: Current situation and future scaling up	


Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
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 learned, 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 of watermelon 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	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"> • 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 Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities for the various gender categories i.e. youths, women and men performing the task.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to land for Watermelon cultivation 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"> • Employment opportunities for youths exist in performing the task.
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 up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau, Orayo M., Odhiambo H. and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

2.6.8 TIMP name	Tied Ridges
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low crop yields arising from the risk of soil erosion and increased run off; low soil water retention capacity in most soils.
What is it? (TIMP description)	Tied ridges are small earthen ridges, 30 cm high, with an upslope furrow which accommodates water between the ridges. The management practice consists of water flowing down the small trenches/furrows running parallel and infiltrates into crop root zones. Water is applied to the top end of each furrow and flows down the crop field under the influence of gravity.
Justification	With limitations in soil moisture due to decreasing rainfall occasioned by climatic changes, tied ridges help 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.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers and Extension officers
Approaches to be used in dissemination	<ul style="list-style-type: none"> 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.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Availability of labour since the management practice is labour intensive. Farmers and extension service with skills to design and construct grass strips. 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 and capacity building Community farmer groups – Provide on farm demonstration plots to hold Farmer Field Schools.

	<ul style="list-style-type: none"> External service providers – capacity building and access to the management practice.
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	All other Counties with suitable agro-ecological settings for Watermelon production.
Challenge(s) in development and 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.
Suggestions 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 learned, if any	<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	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"> 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 Watermelon cultivation than men. Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> Employment opportunities for the various gender categories i.e. youths, women and men performing the task.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs have limited access to land for Watermelon cultivation 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"> 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 Watermelon cultivation than men. Women have less access to agricultural information, technology and knowledge than men.
E: Case studies/profiles of success stories	
Success stories, if any	-

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 MoALF: Training Manual for Water Users Association and farmers
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	Ready for up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau, Orayo M., Odhiambo H. and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

2.6.9 TIMP name	Rain water harvesting systems (ponds and dams)
Category (i.e. technology, innovation or management practice)	<p>Management Practice</p>  <p style="text-align: center;">Water harvesting pond</p>
A: Description of the technology, innovation or management practice	
Problem addressed	Water scarcity for watermelon production especially in the face of diminishing rainfall because of climate change
What is it? (TIMP description)	Rain water harvesting is a method 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). A vast number of methods allow flexibility and adaptability to site-specific situations to best fight water scarcity and make watermelon production more resilient. One method of rainwater harvesting is rooftop harvesting and harvesting through earth dams.


Justification	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. By collecting, storing and utilizing water for watermelon production, farmers are able to prevent soil erosion, stabilize water supply, and reduce reliance on other water sources. Smallholder farmers can also recoup initial investment costs in water harvesting by extending their watermelon growing season through the entire year. Technology also slows water runoff and increases yields with the additional water.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural 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 • County government – capacity building, policy support, credit facilities, • NGOs – access to technologies, capacity building, technology installation • Community farmer groups – Provide on farm demonstration plot to hold farmer field schools.
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	West Pokot, Elgeyo-Marakwet, Laikipia, Samburu and Wajir
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Resource use conflicts where land is communally owned • Limited skills in management practice implementation • Limited community mobilization policy for water related activities

	<ul style="list-style-type: none"> • 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 methods 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 learned, 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 rain water harvesting methods that are gender sensitive – target different gender needs • Carry out environment and social impact assessment of rain water harvesting methods in specific Counties and cultures • Support structures that help access to credit for rain water harvesting methods 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	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"> • The technology will reduce women’s time burden of walking far distances in search for water • The management practice requires heavy capital investment that may be out of 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 practice • 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,	<ul style="list-style-type: none"> • The labour cost of adopting this management practice might be out of reach for the VMGs thus affecting adoption and scaling up • VMGs have limited access to land for dam construction

dissemination, adoption and scaling up	<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"> • The technology will reduce the time burden of fetching water by the VMGs • Development of SMEs such as food gardens and tree nurseries will increase the income and food for the VMGs
E: Case studies/profiles of success stories	
Success stories, if any	-
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 up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamungo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau; M. Orayo; H Odhiambo and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

Research Gaps for further research

1. Development of models of rain water harvesting for intensive watermelon production and household use.

2.6.10 TIMP name	Conservation Agriculture (CA)
Category (i.e. technology, innovation or management practice)	<p>Innovation</p>  <p>Conservation agriculture practice of maximum ground cover</p>
A: Description of the technology, innovation or management practice	
Problem 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)	Conservation agriculture is an innovation which maximizes on saving water by adhering to specific principles that govern it. 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. 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
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 (CA) has potential to:</p> <ul style="list-style-type: none"> • Enhance management of soil fertility and organic matter, and improvement of the efficiency of nutrient inputs, helping to produce more with proportionally less fertilizer. • 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 • Avoidance of tillage minimizes occurrence of net losses of carbon dioxide by microbial respiration and oxidation of the soil organic matter and build soil structure and bio pores through soil biota and roots • 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 • Helps to reduce soil compaction and plough pans and regenerates degraded lands
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms

Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Training on principles and benefits of CA • Model demonstration using crops
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Private sector – access to technology, access to credit, technology installation • NGOs (African Conservation Network, One Acre Fund) –capacity building, dissemination of information • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools. • CIAT, FAO – capacity building • County Governments - Funding CA activities, support capacity building, enabling environment and supportive policies
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	West Pokot, Elgeyo-Marakwet, Laikipia, Samburu and Wajir
Challenge(s) in development and 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 CA where they do not have clear land rights) • Limited knowledge on the incremental benefits of CA • Limited access to CA 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 management practice • Allocation of more funds for continued research and dissemination of this management practice would aid increased uptake of CA with agroforestry
Lessons learned, if any	<ul style="list-style-type: none"> • Uptake of CA innovation increases with the realized incremental benefits over time • Continuous capacity building increases CA innovation uptake
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Develop Integrated Herbicide Management Plan – pre-emergence and post-emergence herbicides • Reliable management practice adoption and suitable price and market access for watermelon production under CA • Continuous capacity building of the community on the benefits of CA innovation • County policies that support households investing in CA with inputs like implements
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,	<ul style="list-style-type: none"> • The technology may reduce women work burden when it comes to weeding.

dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited access to land for Watermelon cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	<ul style="list-style-type: none"> • CA with trees is a management practice that that can be easily adopted by women.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The practice may reduce VMGs work burden when it comes to weeding. • VMGs have less access to agricultural information, technology and knowledge than men. • VMGs have limited access to land for Watermelon cultivation than men.
VMG related opportunities	<ul style="list-style-type: none"> • CA with trees is a management practice that that can be easily adopted by VMGs.
E: Case studies/profiles of success stories	
Success stories, if any	-
Application guidelines for users	<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 up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau; M. Orayo; H Odhiambo and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

Research Gaps for further research

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

2.6.11 TIMP name	Watermelon – Legume/cereal intercropping
Category (i.e. technology, innovation or management practice)	Management practice



Watermelon- cereal intercrop

A: Description of the technology, innovation or management practice	
Problem addressed	Decreased yields due to declining soil fertility, erosion, weed infestation and crop vulnerability to pests and diseases. - practice helps slow the proliferation of pests and protect yields
What is it? (TIMP description)	<p>Watermelon legume/cereal intercropping is a multiple cropping practice involving growing two or more crops 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 crop. The practice offers the potential to increase yields, enhance soil fertility and minimize the effects of climate change.</p> <ul style="list-style-type: none"> • Single row intercropping: involves the component watermelon and the pigeon pea arranged in alternate single rows. The space between the two watermelon rows is 150cm and the legume is planted in between so that between legume and watermelon row is 100cm. • Strip intercropping: multiple rows, or a strip, of the legume is alternated with single or several rows of watermelon. The inter row spacing between legume is 100cm and legume to watermelon is 100 cm. The space between two watermelon rows is 100cm. <p>Control of pest through intercropping</p> <ul style="list-style-type: none"> • 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. • Trap cropping, this involves planting a crop nearby that is more attractive for pests compared to watermelon, the pests will target this crop and watermelon. • Repellent intercrops are crops that have a repellent effect to certain pests. This system involves the repellent crop masking the smell of watermelon crop in order to keep pests away from it.
Justification	Climate change is negatively impacting watermelon productions. Farmers are experiencing low yields, crop failures, declined soil fertility and generally low farm returns from their investments. Intercropping is one of the potential management practices of enhancing climate change adaptation. It offers the


	<p>potential to increase yield, enhance soil fertility/biodiversity and minimize the effects of climate change. Intercropping of legumes/cereals encourages biodiversity by providing a habitat for a variety of insects and soil organisms that would not be present in a single-crop environment. 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, extension Agents (Public and Private), research organizations and universities, as well as CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural 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 watermelon • 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"> • NGOs – to provide support on capacity building and micro-financing services • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools. • CIAT, FAO – capacity building • County Governments - Funding CA activities, support capacity building, enabling environment and supportive policies
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	West Pokot, Elgeyo-Marakwet, Laikipia, Samburu and Wajir

Challenge(s) in development and 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 learned, 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 up scaling. 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	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"> • Complexity of the intercropping system may result in increased labour for women who perform most of the Watermelon production activities such as planting and weeding. • Women have less access to information, technology and knowledge. • Women have less access to land and credit that can be used for dry watermelons farming than men. • Women have limited access to education, training and extension services than men.
Gender related opportunities	<ul style="list-style-type: none"> • Intercropping offers good opportunities 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 and credit for dry watermelons farming. • VMGs have limited access to training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.

	<ul style="list-style-type: none"> • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • Intercropping offers good opportunities to VMGs to grow diverse crops for economic gains and at the same time offers enhanced biodiversity benefits.
E: Case studies/profiles of success stories	
Success stories, if any	-
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)	Ready for up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau; M. Orayo; H Odhiambo and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

Research Gaps for further research

1. Major information Research 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 watermelon and legumes in some areas – the need for site specific validation.
2. Little information on the interactions of various crop intercrops especially in the arid and semi-arid areas (ASALs).
3. Limited knowledge on resource-use efficiency particularly in regions with impoverished soils (ASALs) and economies where measured benefits is greatest.

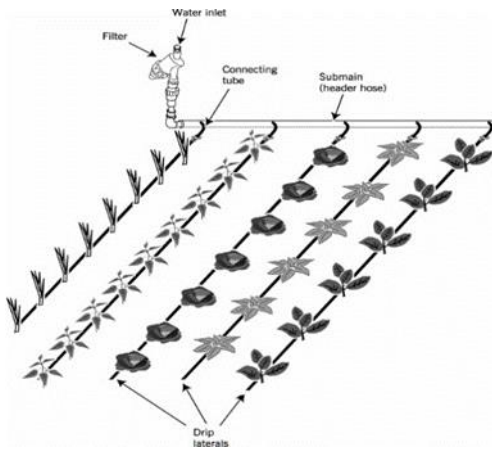
2.6.12 TIMP name	Mulching
Category (i.e. technology, innovation or management practice)	Management practice  Mulching in watermelon (Source: KALRO)
A: Description of the technology, innovation or management practice	
Problem addressed	Yield decline due to accelerated loss of soil moisture-water stress in the soil. Suppression of weeds, loss of organic matter, managing salinity in ASALS.
What is it? (TIMP description)	The practice of covering the soil/ground with natural materials such as straw, dead leaves and compost to make more favorable conditions for plant growth, development and efficient watermelon production. The benefits include: soil moisture retention, weeds suppression, keeping the soil cool and improving soil fertility (as the mulches decompose).
Justification	Mulching facilitates retention of soil moisture and helps in control of temperature fluctuations, improves physical, chemical and biological properties of soil, as it adds nutrients to the soil and ultimately enhances the growth and yield of crops. It minimizes weed problems and nutrient loss. It also improves soil; structure directly by preventing raindrop impact and indirectly by promoting biological activity.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals)

	<ul style="list-style-type: none"> • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of plant or crop residues. • Size of the land. • Competing uses of crop residues. • Type of the crops
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Community farmer groups – Provide on farm demonstration plots to hold farmer field schools. • County Governments - support capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	West Pokot, Elgeyo-Marakwet, Laikipia, Samburu and Wajir
Challenge(s) in development and dissemination	<ul style="list-style-type: none"> • Lack of enough plant and crop residues due to competing uses • Possibilities of insect build up categorized as pest or disease vectors
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Crop diversification to increase availability of residues. • Establish and follow a good integrated pest control management program for the particular crop. • Adapting alternative mulching materials like high absorbance polymers
Lessons learned, if any	<ul style="list-style-type: none"> • There is need to adapt to alternative mulching technologies in addition to use of organic materials like crop, plant residues, and agricultural processing wastes.
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	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"> • Mulching is labour intensive hence it may increase the labour burden for the various gender categories. This may lead to the management practice not being adopted especially by women who are already overburdened. • The TIMP will reduce women’s weeding time that can be used performing other productive activities.
Gender related opportunities	<ul style="list-style-type: none"> • The TIMP can offer employment opportunities for the youths. • The mulch is locally available on-farm.
VMG issues and concerns in development,	<ul style="list-style-type: none"> • Since the activity is labour intensive it may increase the labour burden for the various gender categories. This may lead to the practice not to be adopted.

dissemination, adoption and scaling up	<ul style="list-style-type: none"> The TIMP will reduce women's weeding time that can be used performing other productive activities.
VMG related opportunities	<ul style="list-style-type: none"> The TIMP can offer employment opportunities for the youths. The mulch is locally available on-farm.
E: Case studies/profiles of success stories	
Success stories, if any	-
Application guidelines for users	-
F: Status of TIMP readiness (Ready for upscaling, Requires validation; Requires further research)	Ready for up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamungo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau; M. Orayo; H Odhiambo and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

Research Gaps for further research

1. Research on mulching using factory/industrial wastes, e.g. mushroom, tea, coffee, etc. in different value chains is required.

2.6.13 TIMP name	Drip irrigation systems for small scale farmers
Category (i.e. technology, innovation or management practice)	<p>Technology</p>  <p>Layout of a drip irrigation system in vegetables</p>
A: Description of the technology, innovation or management practice	
Problem addressed	Water stress caused by seasonal rainfall variability in rain fed production.

What is it? (TIMP description)	This is the supplemental water provided in watermelon production. 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 increased crop yields. It's easy to design and operated. The layout can either be above surface or buried below the surface. Drip irrigation system provides efficient fertilizer usage (fertigation) with irrigation water
Justification	The impacts of climate change (seasonal rainfall variability and drought) to watermelon production is a real threat to food security. Mainstreaming drip irrigation systems into watermelon production provides the opportunity to enhance crop resilience, increase yields and incomes.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural 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 on drip management skills
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Community farmer groups; Provide on farm demonstration plots to hold farmer field schools. • County governments; capacity building, supportive policies and frameworks • Private sector (AMIRAN); facilitate access to drip irrigation system; demonstrations; access to credit • NGOs (Kenya Red Cross- KRC, Action Aid, World Vision, and OXFAM); facilitate access to drip irrigation system; demonstrations
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be promoted	West Pokot, Elgeyo-Marakwet, Laikipia, Samburu and Wajir

Challenge(s) in development and 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
Suggestions 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 learned, if any	<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	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 youths have less access to credit required to install drip irrigation. • Women have less access to technology and information on the TIMP. • Women have less access to education, training and extension services.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youths in installing the drip irrigation kits.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs have less access to credit required to install drip irrigation. • VMGs have less access to the management practice and information on the TIMP. • VMGs have less access to education, training and extension services.
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youths in installing the drip irrigation kits.
E: Case studies/profiles of success stories	
Success stories, if any	-


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 (Ready for upscaling, Requires validation; Requires further research)	Ready for up-scaling
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 and scientists	KALRO, E. Mutuma; J. Wamungo; M. Wairimu; P. Kitiem, J. Mwaura; D. Kamau; M. Orayo; H Odhiambo and A.O. Esilaba.
Partner organizations	County Governments, extension offices, Universities

Research Gaps for further research

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

2.7 Watermelon Crop Health

2.7. Integrated Management Of Watermelon Pests

2.7.1 TIMP name	Integrated management of Melon/cotton Aphid (<i>Aphis gossypii</i>) in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss of 30% due to aphid infestation 

	Source: ag.umass.edu
What is it? (TIMP description)	<p>This is an integrated approach of various control methods suppress the aphids below economic injury levels.</p> <p>Cultural Control</p> <ul style="list-style-type: none"> • Prepare land well and apply 10 kg CAN/acre and 14 kgs/acre DAP to increase plant vigour • Control ants by ploughing and flooding the field to destroy the colonies, expose eggs and larvae to predators • Conserve natural enemies (e.g. flower bugs, lady bird beetles, praying mantis, hover flies, green lace wing, long horned grass hoppers and spiders) by planting lantana hedges to act as breeding grounds for predators • Rotate with non-host crops e.g. maize, upland rice, sorghum, okra, sugarcane, and sunflower to prevent build-up of population. Avoid alternate host crops such as beans, lucerne, • Remove heavily infested plant parts and destroy by burning • Spray with soapy water solution (mix 1 tablespoon of teepol detergent with 4 lts of water or use strong jet of water to wash off aphids) <p>Bio-control</p> <ul style="list-style-type: none"> • Apply neem based products (e.g. neem oil 40ml/20lts of water, Achook) 2 times/month <p>Chemical Control</p> <ul style="list-style-type: none"> • Use Danadim Blue 40 EC(Dimethoate 400 g/L) • Duduthrin 1.75 EC (<i>Lambdacyhalothrin</i> 17.5 g/L) • Spray using 10 - 15 mls/20lts of Karate, Atom or Decis at the rate of 10-15mls/20lts of water • Manufacturers recommendations should be observed
Justification	<p>Aphid is one of the major pests affecting Watermelon production in Kenya. Losses of up to 30% have been experienced. Integrated management of Aphid is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.</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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and

	<p>adoption of the technology</p> <ul style="list-style-type: none"> • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • In adequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform

	<ul style="list-style-type: none"> Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> Favorable environmental conditions Willingness of stakeholders to participate Favorable environmental conditions Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality Producers willing to adopt the insect management practices Producers are organized in groups to ensure that management practices are effectively up-scaled Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 4,350
Estimated returns	Approximately Ksh 200,000. If IPM of melon aphids is not applied the yield will be reduced by 30%. Therefore, the estimated returns will be 200,000-60,000= Ksh 140,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> Women and youth have limited knowledge on IPM for Melon/cotton Aphid due to lack of access to agricultural information and extension services Women and youth might not be able purchase the chemical used to for IPM for Melon/cotton Aphid because they do not have finances due to limited access to credit facilities Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for Melon/cotton Aphid IPM for Melon/cotton Aphid is cheap and reduces production costs therefore user friendly to poor women Where IPM will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop Adoption of IPM for Melon/cotton Aphid will lead to improved productivity of watermelon hence more income for women Adoption of IPM for Melon/cotton Aphid will also lead to increased food security and nutrition for households


	<ul style="list-style-type: none"> • IPM adoption for Melon/cotton Aphid will lead to employment opportunities for women and youth at various nodes of watermelon value chain
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 agricultural information and extension so they might not be aware of IPM • VMGs lack finances due to limited access to credit facilities they might not be able to purchase some of the chemicals used for control of watermelon diseases • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM for Melon/cotton Aphid will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.

F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org</p> <p>Institute Director, Apiculture Research Institute P.O Box 32-30403 Marigat, Kenya Tel:0773479016/7 Email: director.ari@kalro.org</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

Research Gaps:

1. Explore bio-control options for controlling the aphids to minimize on pesticide use
2. Explore the efficacy of ITKs in management of aphids under high pressure

2.7.2 TIMP name	Integrated management of Pickle worm/melon worm (<i>Diaphania hyalinata</i>) in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss of approximately 30% due to Pickle worm/melon worm infestation

	 <p>Larvae and Adult of Pickleworm on Watermelon leaves Source: University of Florida</p>
<p>What is it? (TIMP description)</p>	<p>Integrated management of melon Pickle worm/melon worm includes the use of various pest control strategies. The strategies include cultural, biological and chemical control.</p> <p>Cultural practises</p> <ul style="list-style-type: none"> • Early planting • Sanitation and weed control • Trap cropping with squash <p>Biological management</p> <ul style="list-style-type: none"> • Spray neem oil solution. Add 30ml neem oil into 250ml of liquid soap stir well. (Liquid soap/emulsifier-ensures that the oil and water can mix well). Add 1L water and mix well. Use the solution immediately. If not, the oil droplets will start floating. Spray with knapsack sprayer, early morning or evening <p>Chemical management</p> <ul style="list-style-type: none"> • Use of appropriate contact insecticide such as malathion (2ml/l of water). Manufacturers recommendations should be observed
<p>Justification</p>	<p>Pickle worm is one of the major pests affecting Watermelon production in Kenya. Losses of up to 30% have been experienced. Integrated management of Pickle worm is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Farmers, extension Agents (Public and Private), research organizations and universities, as well as CGIAR's</p>
<p>Approaches to be used in dissemination</p>	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations

	<ul style="list-style-type: none"> • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management

	<ul style="list-style-type: none"> • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms

Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 4,500
Estimated returns	Approximately Ksh 200,000. If IPM of pickle worm is not applied the yield will be reduced by 30%. Therefore, the estimated returns will be 200,000-60,000= Ksh 140,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for Pickle worm/melon worm due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used to for IPM for Pickle worm/melon worm because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for Pickle worm/melon worm • IPM for Pickle worm/melon worm is cheap and reduces production costs therefore user friendly to poor women • Where IPM for Pickle worm/melon worm will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • There will be creation of job opportunities for the youth in setting • Adoption of IPM for Pickle worm/melon worm will lead to improved productivity of watermelon hence more income for women


	<ul style="list-style-type: none"> • Adoption of IPM for Pickle worm/melon worm will also lead to increased food security and nutrition for households • IPM adoption for Pickle worm/melon worm will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM is adopted.
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 agricultural information and extension so they might not be aware of IPM for Pickle worm/melon worm • VMGs lack finances due to limited access to credit facilities they might not be able to purchase some of the chemicals used for control of watermelon diseases • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying •
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Reference:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p.

	<ul style="list-style-type: none"> Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org</p> <p>Institute Director, Apiculture Research Institute P.O Box 32-30403 Marigat, Kenya Tel:0773479016/7 Email: director.ari@kalro.org</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

Research Gaps:

1. Explore bio-control options for controlling pickle worm to minimize on pesticide use
2. Explore the efficacy of ITKs in management of pickle worm under high pressure

2.7.3 TIMP name	Integrated management of Leaf cutting beetle (<i>Diabrotica seporata</i>) in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss by 20% due to Leaf cutting beetle infestation

	 <p style="text-align: center;">Source: entomology.ca.uky.edu</p>
<p>What is it? (TIMP description)</p>	<p>Integrated management of melon Leaf cutting beetle includes the use of various pest control strategies. The strategies include cultural, biological and chemical control.</p> <p>Cultural control</p> <ul style="list-style-type: none"> • Preventive control measures are sanitation by removal of plants and all debris as soon as harvesting is over. • Hand pick and destroy the beetles at the beginning of infestation as this will help to reduce the population density • Remove alternative host near the crop <p>Biological control</p> <ul style="list-style-type: none"> • Use natural enemies such as domestic chicken and allow perching birds to prey on beetles • Use biopesticides such as Nimbecidine EC (<i>Azadirachtin 0.03%</i>). <p>Chemical control Use only pest control products recommended by Pest Control Products Board (PCPB) such as:</p> <ul style="list-style-type: none"> • Bulldozer star EC 262.5 (<i>Beta-cyfluthrin 12.5 g/L + Chlorpyrifos 250 g/L</i>) • Tata-alpha 10 EC (<i>Alpha-cypermethrin (10 g/L)</i>) • Decis 2.5 EC (<i>Deltamethrin 25g/L</i>) • Duduthrin 1.75 EC (<i>Lambdacyhalothrin 17.5 g/L</i>)
<p>Justification</p>	<p>Leaf cutting beetle is one of the major pests affecting Watermelon production in Kenya. Losses of up to 20% have been experienced. Integrated management of Leaf cutting beetle is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use</p>

	of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.

Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest.

	<ul style="list-style-type: none"> • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 4,400
Estimated returns	Approximately Ksh 200,000. If IPM of leaf cutting beetle is not applied the yield will be reduced by 20%. Therefore, the estimated returns will be 200,000-40,000= Ksh 160,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for Leaf cutting beetle due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IPM for Leaf cutting beetle because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for Leaf cutting beetle • IPM for Leaf cutting beetle is cheap and reduces production costs therefore user friendly to poor women • Where IPM for Leaf cutting beetle will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps and marketing pest traps • Adoption of IPM for Leaf cutting beetle will lead to improved productivity of watermelon hence more income for women


	<ul style="list-style-type: none"> • Adoption of IPM for Leaf cutting beetle will also lead to increased food security and nutrition for households • IPM adoption for Leaf cutting beetle will lead to employment opportunities for women and youth at various nodes of watermelon value chain.
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 agricultural information and extension so they might not be aware of IPM for Leaf cutting beetle • VMGs lack finances due to limited access to credit facilities they might not be able to purchase some of the chemicals used for control of watermelon diseases • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying •
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. Texas FARMER Collection. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S.

	Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org</p> <p>Institute Director, Apiculture Research Institute P.O Box 32-30403 Marigat, Kenya Tel:0773479016/7 Email: director.ari@kalro.org</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

Research Gaps:

1. Explore bio-control options for controlling the Leaf cutting beetle to minimize on pesticide use
2. Explore the efficacy of ITKs in management of Leaf cutting beetle under high pressure

2.7.4 TIMP name	Integrated management of thrips (<i>Thrips palni</i>) in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss by 30% due to thrips infestation

	
<p>What is it? (TIMP description)</p>	<p>Integrated management of thrips includes the use of various pest control strategies. The strategies include cultural, biological and chemical control.</p> <p>Cultural practises</p> <ul style="list-style-type: none"> • Maintain a healthy crop as it will tolerate thrips and keep the field weed free • Avoid planting new crop near an existing infected field • Mulch fields as this helps reduce thrips population • Use overhead irrigation where possible to reduce spread of thrips • Remove and destroy volunteer plants and debris that may harbour thrips • Uproot heavily infested plant material and burn • Apply soapy sprays (mix 5 teaspoon full of soap powder or chopped bar soap with cold water and dissolve and spray on the infested plants • Use blue sticky cardboard traps to attract thrips. <p>Biological control</p> <ul style="list-style-type: none"> • Apply biocontrol agents e.g Beauvitech WP (Beauveria bassiana) or Bio-Power 1.5L (Beauveria bassiana), or Botanigard ES (Azadirachtin), • Spray neem based products like neemroc EC and nimbecidine (Azadiractin) use 1 lts/acre (10 plastic bottle tops per 20 lts of water). <p>Chemical Control</p> <ul style="list-style-type: none"> • Spray with Spinosad based products eg tracer 480 SC at 4mls per 20lts of water or lambda cyhalothrin products at 7ml per 20l of water or duduthrin at 65mls per 20l of water or Karate at 20gms/ 20l • Use synthetic insecticides with PHI of 3 days or less since watermelon is harvesting at very short intervals.
<p>Justification</p>	<p>Thrips are among the major pests affecting Watermelon production in Kenya. Losses of up to 30% have been</p>

	experienced. Integrated management of thrips is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel

	/Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing


Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 3,800
Estimated returns	Approximately Ksh 200,000. If IPM of thrips is not applied the yield will be reduced by 30%. Therefore, the estimated returns will be 200,000-60,000= Ksh 140,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for thrips due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IPM for thrips because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for thrips • IPM for thrips is cheap and reduces production costs therefore user friendly to poor women • Where IPM for thrips will involve mulching it will add more work to women who are already burdened by their domestic roles •

Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IPM for thrips will lead to improved productivity of watermelon hence more income for women • Adoption of IPM for thrips will also lead to increased food security and nutrition for households • IPM adoption for thrips will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM for thrips is adopted.
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 agricultural information and extension so they might not be aware of IPM for thrips • VMGs lack finances due to limited access to credit facilities they might not be able to purchase some of the chemicals used for control of watermelon diseases • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM for thrips will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying •
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	References: <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>.

	<ul style="list-style-type: none"> • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org</p> <p>Institute Director, Apiculture Research Institute P.O Box 32-30403 Marigat, Kenya Tel:0773479016/7 Email: director.ari@kalro.org</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

Research Gaps:

1. Explore bio-control options for controlling the thrips to minimize on pesticide use
2. Explore the efficacy of ITKs in management of thrips under high pressure

2.7.5 TIMP name	Integrated management of white fly (<i>Bemisia tabaci</i>) in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<p>Yield loss by 40% due to white fly infestation</p>  <p>Whitefly infestation on Watermelon leaves Source: rajendra 07112.weebly.com</p>
What is it? (TIMP description)	<p>This is an integrated approach of various control methods suppress the white flies below economic injury levels.</p> <p>Cultural Control</p> <ul style="list-style-type: none"> • Prepare land well and apply 10 kg CAN/acre and 14 kgs/acre DAP to increase plant vigour • Control ants by ploughing and flooding the field to destroy the colonies, expose eggs and larvae to predators • Conserve natural enemies (e.g. flower bugs, lady bird beetles, praying mantis, hover flies, green lace wing, long horned grass hoppers and spiders) by planting lantana hedges to act as breeding grounds for predators • Rotate with non-host crops e.g. maize, upland rice, sorghum, okra, sugarcane, and sunflower to prevent build-up of population. Avoid alternate host crops such as beans, lucerne, watermelon • Remove heavily infested plant parts and destroy by burning • Spray with soapy water solution (mix 1 tablespoon of teepol detergent with 4 lts of water or use strong jet of water to wash off aphids) <p>Bio-control</p> <ul style="list-style-type: none"> • Apply neem based products (e.g. neem oil 40ml/20lts of water, Achook) 2 times/month

	<p>Chemical Control</p> <ul style="list-style-type: none"> • Use Danadim Blue 40 EC(Dimethoate 400 g/L) • Duduthrin 1.75 EC (<i>Lambdacyhalothrin 17.5 g/L</i>) • Spray using 10 - 15 mls/20lts of Karate, Atom or Decis at the rate of 10-15mls/20lts of water <p>Manufacturers recommendations should be observed</p>
Justification	White fly is one of the major pests affecting Watermelon production. Losses of up to 40% have been experienced. Integrated management of White fly is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices

	<ul style="list-style-type: none"> • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests.

	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 3,000
Estimated returns	Approximately Ksh 200,000. If IPM of whitefly is not applied the yield will be reduced by 40%. Therefore, the estimated returns will be 200,000-80,000= Ksh 120,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for white fly due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IPM for white fly because they do not have finances due to limited access to credit facilities

	<ul style="list-style-type: none"> • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for white fly • IPM for white fly is cheap and reduces production costs therefore user friendly to poor women • Where IPM for white fly will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • • Adoption of IPM for white fly will lead to improved productivity of watermelon hence more income for women • Adoption of IPM for white fly will also lead to increased food security and nutrition for households • IPM adoption for white fly will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM for white fly is adopted.
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 agricultural information and extension so they might not be aware of IPM for white fly • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • There will also a reduction of cost of production for VMGs if IPM for white fly is adopted
E: Case studies/profiles of success stories	
Success stories	-

Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
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Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

Research Gaps:

1. Explore bio-control options for controlling the white fly to minimize on pesticide use
2. Explore the efficacy of ITKs in management of white fly under high pressure

<p>2.7.6 TIMP name</p>	<p>Integrated management of Rind worm (<i>Liriomyza sp</i>) in Watermelon</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 addressed</p>	<p>Yield loss by 60% due to Rind worm infestation</p> <div> </div> <p>Source: nwdistrict.ifas.ufl.edu</p>
<p>What is it? (TIMP description)</p>	<p>Integrated management of Rind worm applies a combination of several approaches to manage the pest cycle. These include:- cultural, biological and chemical control.</p> <p>Cultural Control</p> <ul style="list-style-type: none"> • Plant clean seedlings free from all stages of the moth. • Rotate with non-host crops such as maize, beans and cabbages. • Remove and bury all infested plants, foliage and infected crop residues in a deep pit (over 1m). • Remove infested leaves before the caterpillar pupates inside and becomes an egg-laying adult. <p>Bio-control</p> <ul style="list-style-type: none"> • Use of <i>Bacillus thuringiensis</i> at recommended rates • Use of Pheromone traps • Use sticky traps - 24 pcs/acre <p>Chemical Control</p> <ul style="list-style-type: none"> • Spray spinetoram (Radiant 120 SC(R)) at rate of 18-30ml/20lts of water • Chlorantraniliprol (Corragen 20 SC(R)) at rate of 2ml/20lts of water • Belt insecticide.

Justification	Rind worm is one of the major pests affecting watermelon production. Losses of up to 40% have been experienced. Integrated management of Rind worm is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks


	<ul style="list-style-type: none"> • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options

	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 4,250
Estimated returns	Approximately Ksh 200,000. If IPM of rindworm is not applied the yield will be reduced by 60%. Therefore, the estimated returns will be 200,000-120,000= Ksh 80,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for Rind worm due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IPM for Rind worm because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for Rind worm • IPM for Rind worm is cheap and reduces production costs therefore user friendly to poor women

	<ul style="list-style-type: none"> • Where IPM for Rind worm will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • • There will be creation of job opportunities for the youth • Adoption of IPM for Rind worm will lead to improved productivity of watermelon hence more income for women • Adoption of IPM for Rind worm will also lead to increased food security and nutrition for households • IPM adoption for Rind worm will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM for Rind worm is adopted.
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 agricultural information and extension so they might not be aware of IPM for Rind worm • VMGs lack finances due to limited access to credit facilities they might not be able to purchase some of the chemicals used for control of watermelon diseases • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM for Rind worm will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying

	<ul style="list-style-type: none"> • There will also a reduction of cost of production for VMGs if IPM for Rind worm is adopted
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	Reference: Alford, D. V. (Ed.). (2008). <i>Pest and disease management handbook</i> . John Wiley & Sons.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org</p> <p>Institute Director, Apiculture Research Institute P.O Box 32-30403 Marigat, Kenya Tel:0773479016/7 Email: director.ari@kalro.org</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

2.7.7 TIMP name	Integrated management of Leaf miner (<i>Liriomyza sp</i>) in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss of 50% due to Leaf miner infestation

	 <p style="text-align: center;">Source: Lusike Wasilwa-KALRO</p>
<p>What is it? (TIMP description)</p>	<p>Integrated management of leaf miner applies a combination of several approaches to manage the pest cycle. These include:- cultural, biological and chemical control.</p> <p>Cultural Control</p> <ul style="list-style-type: none"> • Plant clean seedlings free from all stages of the moth. • Rotate with non-host crops such as maize, beans and cabbages. • Remove and bury all infested plants, foliage and infected crop residues in a deep pit (1 m). • Remove infested leaves before the caterpillar pupates inside and becomes an egg-laying adult. <p>Bio-control</p> <ul style="list-style-type: none"> • Use of <i>Bacillus thuringiensis</i> at recommended rates • Use of Pheromone traps 8traps/acre • Use sticky traps - 24 pcs/acre <p>Chemical Control</p> <ul style="list-style-type: none"> • Spray spinetoram (Radiant 120 SC(R)) at rate of 18-30ml/20lts of water or • Chlorantraniliprol (Coragen 20 SC(R)) at rate of 2ml/20lts of water or • Spray Flubendiamide products e.g Belt insecticide according to manufacturers' recommendation
<p>Justification</p>	<p>Leaf miner is one of the major pests affecting Watermelon production. Losses of up to 50% have been experienced. Integrated management of Leaf miner is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-</p>

	free for Watermelon farmers and consumers. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trials and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.


Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo
Counties where TIMPs will be up scaled	West Pokot, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management

	<ul style="list-style-type: none"> • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 5,000 per acre/per season
Estimated returns	<ul style="list-style-type: none"> • Approximately Ksh 200,000. Per acre / per season • If IPM of leaf miner is not applied the yield will be reduced by 50%. Therefore, the estimated returns will be 200,000-100,000= Ksh 100,000 per acre/per season
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for Leaf miner due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IPM for Leaf miner because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for Leaf miner • IPM is cheap and reduces production costs therefore user friendly to poor women • Where IPM for Leaf miner will involve mulching it will add more work to women who are already burdened by their domestic roles

Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • • Adoption of IPM for Leaf miner will lead to improved productivity of watermelon hence more income for women • Adoption of IPM for Leaf miner will also lead to increased food security and nutrition for households • IPM adoption for Leaf miner will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM for Leaf miner is adopted.
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 agricultural information and extension so they might not be aware of IPM for Leaf miner • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM for Leaf miner will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • There will also a reduction of cost of production for VMGs if IPM for Leaf miner is adopted
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Reference:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>.

	<ul style="list-style-type: none"> • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
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Contacts	<p>Centre Director KALRO Kabete, Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org</p> <p>Institute Director, Apiculture Research Institute P.O Box 32-30403 Marigat, Kenya Tel:0773479016/7 Email: director.ari@kalro.org</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

2.7.8 TIMP name	Integrated management of Melon fly (<i>Bactrocera cucurbitae</i>) in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	

<p>Problem addressed</p>	<p>Yield loss by 80% due to Melon fly infestation</p>  <p>Melon fly damage (Source: Jimmy Yegon KALRO)</p>
<p>What is it? (TIMP description)</p>	<p>Integrated management of Melon fly applies a combination of several approaches to manage the pest cycle. These include:- cultural, biological and chemical control.</p> <p>Cultural Control.</p> <ul style="list-style-type: none"> • Rotate with non-host crops such as maize, beans and cabbages. • Remove and bury all infested plants, foliage and infected crop residues in a deep pit (over 1m). <p>Bio-control</p> <ul style="list-style-type: none"> • Use of <i>Bacillus thuringiensis</i> at recommended rates • Use of Pheromone traps • Use sticky traps - 24 pcs/acre <p>Chemical Control</p> <ul style="list-style-type: none"> • Spray spinetoram (Radiant 120 SC(R)) at rate of 18-30ml/20lts of water • Chlorantraniliprol (Corragen 20 SC(R)) at rate of 2ml/20lts of water • Belt insecticide.
<p>Justification</p>	<p>Melon fly is one of the major pests affecting Watermelon production. Losses of up to 80% have been experienced. Integrated management of Melon fly is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Farmers, extension Agents (Public and Private), research organizations and universities, as well as CGIAR's</p>

Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management

	<ul style="list-style-type: none"> • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo,
Counties where TIMPs will be up scaled	West Pokot, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • In adequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform

	<ul style="list-style-type: none"> Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> Favorable environmental conditions Willingness of stakeholders to participate Favorable environmental conditions Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality Producers willing to adopt the insect management practices Producers are organized in groups to ensure that management practices are effectively up-scaled Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 5,400
Estimated returns	Approximately Ksh 200,000. If IPM of melon fly is not applied the yield will be reduced by 80%. Therefore, the estimated returns will be 200,000-160,000= Ksh 40,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> Women and youth have limited knowledge on IPM for Melon fly due to lack of access to agricultural information and extension services Women and youth might not be able purchase the chemical used in IPM for Melon fly because they do not have finances due to limited access to credit facilities Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for Melon fly IPM is cheap and reduces production costs therefore user friendly to poor women Where IPM for Melon fly will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop Adoption of IPM for Melon fly will lead to improved productivity of watermelon hence more income for women Adoption of IPM for Melon fly will also lead to increased food security and nutrition for households

	<ul style="list-style-type: none"> • IPM adoption for Melon fly will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM for Melon fly is adopted.
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 agricultural information and extension so they might not be aware of IPM for Melon fly • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM for Melon fly will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • • There will also a reduction of cost of production for VMGs if IPM for Melon fly is adopted
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>Reference:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S.

	Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org</p> <p>Institute Director, Apiculture Research Institute P.O Box 32-30403 Marigat, Kenya Tel:0773479016/7 Email: director.ari@kalro.org</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

Research Gaps:

1. Explore bio-control options for controlling melon fly to minimize on pesticide use
2. Explore the efficacy of ITKs in management of melon fly under high pressure

2.7.9 TIMP name	Integrated management of Red spider mite in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss 60% due to Red spider mite infestation



Red spider mites on watermelon
Source: pnwhandbooks.org

What is it? (TIMP description)

Integrated management of Red spider mites consists of several approaches applied in an integrated manner to break the cycle of the insect. These include:

Cultural Control

- Keep the farm weed free from the alternative hosts such as solanum family crops that may harbour red spider mites
- Avoid planting tomato next to infested field or crops.
- When moving through the farm, start with the healthy area before moving to infected section.
- Conserve natural enemies or release purchased predatory *Phytoseilus* species from Real IPM or Dudutech Ltd.
- Use overhead irrigation as it helps in drowning the mites hence reducing their population
- Spray with neem extracts (500 grams of leaves in 5 litres of water)
- Prun overcrowded plants and destroy the crop debris by burning.

Bio-control control

- Spray with neembicidine based products such as Ahook
- Release predatory mites (*Phytotech* and *Amblytech* from dudutech) *Phytoseiulus persimilis* species and *Amblyseius cucumeris*
- Conserve natural enemies in the environment or release purchased predatory *Phytoseilus* species from Real IPM or Dudutech Ltd

Chemical Control

- Spray with abamectin 18g/kg based synthetic pesticides (Dynamec 20EC 5ml/20litres water, Knockbect 40EC, 10 ml/20 Litre water) or
- Spray with Amitraz 200g/L based miticides (Kilitac 20EC, Mitac 20 EC. Rate 10ml/20Litre

	water)
Justification	Red spider mite is one of the major pests affecting Watermelon production. Losses of up to 60% have been experienced. Integrated management of Red spider mite is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value

	<p>chain stakeholders</p> <ul style="list-style-type: none"> • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo
Counties where TIMPs will be up scaled	West Pokot, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides


	<ul style="list-style-type: none"> • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 3,500
Estimated returns	Approximately Ksh 200,000. If IPM of red spider mite is not applied the yield will be reduced by 60%. Therefore, the estimated returns will be 200,000-120,000= Ksh 80,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for Red spider mite due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IPM for Red spider mite because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for Red spider mite

	<ul style="list-style-type: none"> • IPM for Red spider mite is cheap and reduces production costs therefore user friendly to poor women • Where IPM for Red spider mite will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IPM for Red spider mite will lead to improved productivity of watermelon hence more income for women • Adoption of IPM for Red spider mite will also lead to increased food security and nutrition for households • IPM adoption for Red spider mite will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM for Red spider mite is adopted.
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 agricultural information and extension so they might not be aware of IPM for Red spider mite • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • • There will also a reduction of cost of production for VMGs if IPM for Red spider mite is adopted.
E: Case studies/profiles of success stories	
Success stories	-

Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org</p> <p>Institute Director, Apiculture Research Institute P.O Box 32-30403 Marigat, Kenya Tel:0773479016/7 Email: director.ari@kalro.org</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

Research Gaps:

1. Explore bio-control options for controlling red spider mite to minimize on pesticide use
2. Explore the efficacy of ITKs in management of red spider mite under high pressure

2.7.10 TIMP name	Integrated management of Root Knot nematodes in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<p>Yield loss by 50% due to Root Knot nematodes infestation</p>  <p>Root knot nematode affecting watermelon Source: Knowledge bank, Plantwise.org</p>
What is it? (TIMP description)	<p>Nematodes affecting watermelon are controlled through cultural management practises and chemical control;</p> <p>Cultural practices</p> <ul style="list-style-type: none"> • Crop rotation with non-leguminous crops i.e. crops in the grass family for 4-6 seasons. • Avoidance of surface run off as it spreads the pest to non-infected areas, uprooting affected plants and burying. • Soil solarization during dry months of the year on severely affected fields. • Cleaning of farm tools and equipment's after use • Incorporate Tithonia or Mexican marigold as green manure into the infested soil during planting <p>Biological control</p> <ul style="list-style-type: none"> • Drench infested soil with neem based products e.g. Nimbecidine at a rate of 60ml/20L <p>Chemical management</p>

	<ul style="list-style-type: none"> • Drench with <i>Trichoderma</i> spp based biopesticides in the rooting media.e.g.Trianum P at a rate of 45g/15L of water
Justification	<p>Nematode is one of the major pests affecting watermelon production. Losses of up to 50% have been experienced. Integrated management of Nematode is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.</p> <p>The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.</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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate

	<ul style="list-style-type: none"> • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms

	<ul style="list-style-type: none"> • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 2,500
Estimated returns	Approximately Ksh 200,000. If IPM of leaf eating caterpillar is not applied the yield will be reduced by 30%. Therefore, the estimated returns will be 200,000-100,000= Ksh 100,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for nematodes due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IPM for nematodes for nematodes because they do not have finances due to limited access to credit facilities


	<ul style="list-style-type: none"> • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for nematodes • IPM for nematodes is cheap and reduces production costs therefore user friendly to poor women • Where IPM for nematodes will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • • Adoption of IPM for nematodes will lead to improved productivity of watermelon hence more income for women • Adoption of IPM for nematodes will also lead to increased food security and nutrition for households • IPM adoption for nematodes will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM for nematodes is adopted.
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 agricultural information and extension so they might not be aware of IPM for nematodes • VMGs lack finances due to limited access to credit facilities they might not be able to purchase some of the chemicals used for control of watermelon diseases • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM will lead to improved productivity of watermelon hence more income for VMGs

	<ul style="list-style-type: none"> • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • • There will also a reduction of cost of production for VMGs if IPM for nematodes is adopted
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. Texas FARMER Collection. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
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Lead organization and scientists	KALRO

	Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

Research Gaps:

3. Explore bio-control options for controlling nematodes to minimize on pesticide use
4. Explore the efficacy of ITKs in management of nematodes under high pressure

2.7.11 TIMP name	Integrated management of Cut worm in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss by 30% due to Cut worm infestation  Source: finegardening.com
What is it? (TIMP description)	<p>Cut worm affecting watermelon is controlled through cultural management practises and chemical control;</p> <p>Cultural practices</p> <ul style="list-style-type: none"> • Crop rotation with non-leguminous crops i.e. crops in the grass family for 4-6 seasons. • Avoidance of surface run off as it spreads the pest to non-infected areas, uprooting affected plants and burying. • Soil solarization during dry months of the year on severely affected fields. • Cleaning of farm tools and equipment's after use • Incorporate Tithonia or Mexican marigold as green manure into the infested soil during planting <p>Biological control</p> <ul style="list-style-type: none"> • Drench infested soil with neem based products e.g. Nimbecidine at a rate of 60ml/20L <p>Chemical management</p> <ul style="list-style-type: none"> • Drench with <i>Trichoderma</i> spp based biopesticides in


	the rooting media.e.g.Trianum P at a rate of 45g/15L of water
Justification	Cut worm is one of the major pests affecting Watermelon production. Losses of up to 30% have been experienced. Integrated management of Cut worm is an effective management package against the pest. It involves the integration of various options including cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders

	<ul style="list-style-type: none"> • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel /Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options

	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 2,500
Estimated returns	Approximately Ksh 200,000. If IPM of cutworm is not applied the yield will be reduced by 60%. Therefore, the estimated returns will be 200,000-120,000= Ksh 80,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for Cut worm due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IPM for Cut worm because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for Cut worm • IPM for Cut worm is cheap and reduces production costs therefore user friendly to poor women

	<ul style="list-style-type: none"> • Where IPM for Cut worm will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • • Adoption of IPM for Cut worm will lead to improved productivity of watermelon hence more income for women • Adoption of IPM for Cut worm will also lead to increased food security and nutrition for households • IPM adoption for Cut worm will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM for Cut worm is adopted.
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 agricultural information and extension so they might not be aware of IPM for Cut worm • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM for Cut worm will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • • There will also a reduction of cost of production for VMGs if IPM for Cut worm is adopted
E: Case studies/profiles of success stories	
Success stories	-

Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
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Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

2.7.12 TIMP name	Integrated management of leaf eating caterpillar in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<p>Yield loss by 30% due to leaf eating caterpillar infestation</p> 
What is it? (TIMP description)	<p>Leaf eating caterpillar affecting watermelon is controlled through cultural management practises and chemical control;</p> <p>Cultural practices</p> <ul style="list-style-type: none"> • Crop rotation with non-leguminous crops i.e. crops in the grass family for 4-6 seasons. • Avoidance of surface run off as it spreads the pest to non-infected areas, uprooting affected plants and burying. • Soil solarization during dry months of the year on severely affected fields. • Cleaning of farm tools and equipment's after use • Incorporate Tithonia or Mexican marigold as green manure into the infested soil during planting <p>Biological control</p> <ul style="list-style-type: none"> • Drench infested soil with neem based products e.g. Nimbecidine at a rate of 60ml/20L <p>Chemical management</p> <ul style="list-style-type: none"> • Drench with <i>Trichoderma</i> spp based biopesticides in the rooting media.e.g.Trianum P at a rate of 45g/15L of water
Justification	<p>Leaf eating caterpillar is one of the major pests affecting Watermelon production. Losses of up to 30% have been experienced. Integrated management of Leaf eating caterpillar is an effective management package against the pest. It involves the integration of various options including</p>

	cultural, physical, biological and chemical options. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers. The use of integrated approach is environmentally beneficial and generally risk-free for Watermelon farmers and consumers.
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 CGIAR's
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Most effective approaches	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate use of pheromone traps and other IPM technologies. • Create a platform for interaction of Watermelon value chain stakeholders on IPM technologies • Farmers adopt appropriate agronomic practices • Have well organized farmer groups and networks
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Support Agro chemical companies to sell biological controls products • Create awareness of the benefits of the IPM management practices • Willingness of stakeholders to participate • Carry out Applied and adaptive research to validate IPM technologies on insects • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Formation of spray service providers (teams) to manage Insects • A strong partnership between technical personnel

	/Extension/companies producing biological control and bio-pesticides products and farmers would enhance promotion.
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Extension agents (both private and public): • Mobilization/sensitization of farmers and extension of the technology • Farmers/CBO: participate in trainings and adoption of the technology • KALRO to continually undertake research in insect management • PCPB to promote registration of insecticides for insect management • Universities to develop the technologies and conduct ToTs. • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • CGIAR/NGOs to link farmers to the market and lobby for changes in agriculture policies to favour the farmer. • Financial institutions to provide credit facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Unwillingness of farmers to adopt IPM technologies • Inadequate knowledge on IPM strategies on insect pests infesting Watermelon and losses attributed to them • Poor linkages among stakeholders in Watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training farmers when to apply the intercropping crop types and promotion of conservation of biological agents to suppress various pests. • Establish Watermelon innovation platforms • Dissemination of integrated pest management practices and safe use of pesticides • PCPB enhance registration of crop protection products • Training of stakeholders in IPM options • Establish Watermelon innovation platforms for technology disseminations • Promote appropriate marketing channels e.g. contract farming, collective production and marketing



Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Sensitization is necessary for people to appreciate the use of IPM in insect management • Adoption of good agricultural practices by farmers is key in management of the pest. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Favorable environmental conditions • Willingness of stakeholders to participate • Favorable environmental conditions • Regulatory bodies e.g. PCPBP, KBS to ensure insecticides sold to farmers are genuine and of high quality • Producers willing to adopt the insect management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 2,500
Estimated returns	Approximately Ksh 200,000. If IPM of leaf eating caterpillar is not applied the yield will be reduced by 30%. Therefore, the estimated returns will be 200,000-60,000= Ksh 140,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IPM for leaf eating caterpillar due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IPM for leaf eating caterpillar because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IPM for leaf eating caterpillar • IPM for leaf eating caterpillar is cheap and reduces production costs therefore user friendly to poor women • Where IPM for leaf eating caterpillar will involve mulching it will add more work to women who are already burdened by their domestic roles







Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IPM for leaf eating caterpillar will lead to improved productivity of watermelon hence more income for women • Adoption of IPM for leaf eating caterpillar will also lead to increased food security and nutrition for households • IPM adoption for leaf eating caterpillar will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IPM for leaf eating caterpillar is adopted.
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 agricultural information and extension so they might not be aware of IPM for leaf eating caterpillar • VMGs lack finances due to limited access to credit facilities they might not be able to purchase some of the chemicals used for control of watermelon diseases • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IPM for leaf eating caterpillar will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • There will also a reduction of cost of production for VMGs if IPM for leaf eating caterpillar is adopted
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	References: <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>.

	<ul style="list-style-type: none"> • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (e.g. 1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for up scaling
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org</p> <p>Institute Director, Apiculture Research Institute P.O Box 32-30403 Marigat, Kenya <u>Tel:0773479016/7</u> Email: director.ari@kalro.org</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi, Kenya. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K Yegon., Ruth Amata., Mercyline Orayo and Harun Odhiambo
Partner organizations	CABI, ICIPE, KEPHIS, Real IPM, Koppert, Universities, County governments

Research Gaps:

1. Explore bio-control options for controlling leaf eating caterpillar to minimize on pesticide use
2. Explore the efficacy of ITKs in management of leaf eating caterpillar under high pressure

2.7.13 TIMP Name	Integrated Weed Management in Watermelon	
Crop management practices	Innovation	
A: Description of the technology, innovation or management practice		
Problem addressed	<ul style="list-style-type: none"> • Weeds competition leading to yield losses and lack of profitability in watermelon cropping systems. Some key weed species including Crab sanguinalis (<i>Digitaria sanguinalis</i>), goose grass (<i>Eleusine indica</i>) infest watermelons growing fields successfully because of their morphological and phenological characteristics which facilitate their competition for nutrients, light, water and space by weeds against crops. • Managing the wide biodiversity of weeds, remains challenging in watermelon fields and there is limited chemical weed control options, broadleaved weeds such as Palmer amaranths, (<i>Amaranthus palmeri</i>), Red pigweed (<i>A. retroflexus</i>) and Sedges including Yellow nutsedge (<i>Cyperus esculentus</i>), and Purple nutsedge (<i>Cyperus rotundus</i>) • Lack of biological knowledge on the many diverse weeds occurring has been hindering the effectiveness of weed management. For instance, <i>A. pameri</i> grows upright and causes shading of the watermelon 3 weeks after transplanting, thus depriving the crop of adequate access to sunlight for photosynthesis. The net effect of this in reduced fruit sizes and numbers and ultimate loss to farmers. • Given that production is optimum at four watermelon fruits per vine, and three vines per Melon plant in a given environment, the presence of weeds leads to reduced average yield because melons are poor competitors. 	
		
Wondering jew (Commelina benghalensis) Source Hottensiah Mwangi	Double thorn (Oxygonum sinuatum and starbur (A. hispidum) Source Hottensiah Mwangi	

			
	<p>Pigweed (<i>Amaranthus</i> spp.) Source Hottensiah Mwangi</p>	<p>Sow thistle (<i>Sonchus oleraceae</i>)</p>	
			
	<p>Black jack (<i>Bidens pilosa</i>) Source Hottensiah Mwangi</p>	<p>Gallant soldier (<i>Galinsoga parviflora</i>) Source Hottensiah Mwangi</p>	
			
	<p>Chickweed (<i>Stellaria media</i>) Source Hottensiah Mwangi</p>	<p>Goat weed (<i>Ageratum conyzoides</i>) Source Hottensiah Mwangi</p>	
<p>What is it? (TIMP description)</p>	<ul style="list-style-type: none"> 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>Cultural includes transplanting rather than direct planting, proper fertilization, irrigation, use of cover crops and plastic mulch to reduce weed populations. Watermelon transplants develop more rapidly than directly seeded plants and this increases early season competitiveness of watermelon and may suppress weed emergence due to rapid canopy development particularly in rows. Fertilizer</p>		

	<p>may affect weed populations since watermelons roots reach middle of rows late in the season: So, broadcasting fertilizer early in season fertilizes the weeds in middle row.</p> <p>Drip irrigation and fertilizer in the root zone reduces amounts of fertilizer to weeds. Raised polyethylene plastic beds with drips prevent weeds in rows and allow irrigation and fertilizer to crop root zone. Physical control is the removal of weeds manually or by mechanical means, such as hand weeding or mowing. Farmers carry out manual weeding at 2-3weeks from planting depending on the prevailing environmental conditions, weed density, rainfall amount and frequency or soil types. Chemical control is where appropriate recommended herbicides are applied to control weeds while strictly adhering to the manufacturer's instructions. The identification of weeds in watermelon fields and their growth habits is critical in timely implementation of management practices. Data on weeds can be collected through regular monitoring of fields and maintaining records about weeds occurring in each field. Proper identification of weed species determines the choice of specific management approach because one approach may be effective only on some species and not others.</p>
Justification	<p>Weed infestation in Watermelon systems causes yield losses. Use of inappropriate approaches increases cost of production lowering profitability. Due to limited choice of herbicides for watermelons weed management, a diverse weed control strategy including mechanical, cultural and chemical methods should be adopted. Whereas manual weeding can be effective for managing some weed species, it is time consuming and labour intensive. Besides, manual weeding can be ineffective especially when done under wet conditions, because specific types of weeds such as <i>Commelina benghalensis</i> and <i>Portulaca oleraceae</i> successfully regenerate through cuttings even after manual removal from the fields. Judicious use of herbicides integrated with cultural methods gives a promising option for weed control in watermelon cropping systems.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension workers, Agrodealers
Approaches to be used in dissemination	Demonstrations and field days. Media (Online), manuals, pamphlets.
Gender issues and concerns in development,	Women perform most of the crop production activities such as weeding hence the IWM reduce their work burden.

dissemination, adoption and scaling up	<p>Women and youth have limited access to productive resources such as land and chemicals.</p> <p>Women and youth have limited access to education, training and extension services than men.</p> <p>Women have less access to agricultural information, technology and knowledge.</p>
Gender related opportunities	Employment opportunities exist for youth males and men in spraying.
VMGs issues and concerns in development, dissemination and scaling up	<p>VMGs have limited access to productive resources such as land and chemical.</p> <p>Women and youth have limited access to education, training and extension services than men.</p> <p>Due to their social status VMGs are often excluded from decision making in development and dissemination activities.</p> <p>There is low adoption by VMGs due lack of awareness.</p>
VMGs related opportunities	Employment opportunities exist for youth males in spraying.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Promote and train on integrated weed management (IWM). • Address environmental and safety concerns related to the use of herbicides • Use demos and field days with farmers groups and stakeholders to build capacity on the effectiveness of the various weed management options using FFSSB 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.	Agrochemical companies, Agrodealers, Research partners (KALRO, County extension staffs, NGOs).
C: Current situation and future scaling up	
Counties where already promoted if any	Altitude areas of low altitude and hot areas above sea level e.g. Baringo, Machakos, Makueni, Kajiado, Kirinyaga, & Murang'a.
Counties where TIMPs will be up scaled	All counties suitable for the crop including Rift valley, Central, Eastern, and Coast.
Challenges in development and dissemination	<ul style="list-style-type: none"> • Inadequate knowledge on biology of weeds. • Inadequate knowledge and information on which herbicides to use, when to use them and their persistence in the soil. • High cost of herbicides • Myths on appropriateness of using herbicides

Suggestion for addressing the challenges	<ul style="list-style-type: none"> • Promotion IWM by conducting demos and field days and involve all the stakeholder e.g. agro-chemical companies and agro-dealers. • Develop and disseminate weed biological information and knowledge to stakeholders. • Training on integrated approaches using available methods, including appropriate herbicides for which watermelon. • Develop stakeholder knowledge on herbicides, persistence in different soil environment that can affect follow up crops in the rotation as a result of residues or carryover. • Develop user capacity on safe use of herbicides.
Lesson learned in up scaling if any	<ul style="list-style-type: none"> • That integrated approaches of weed management are more effective than use of one control method, it increases crop productivity, resilience and is environmentally friendly. • Continuous use of herbicide is an environmental, health and social hazard. • Vegetable rotations are very fast and intensive in many places and herbicide toxicity can affect next crop if the cycle of previous crop is short enough. • Consumers concerns
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Build capacity of stakeholders to understand how integrated weed management works. • 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 only appropriate products when required by the farmers.
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	<p>Women perform most of the crop production activities such as weeding hence the IWM reduce their work burden.</p> <p>Women and youth have limited access to productive resources such as land and chemicals.</p> <p>Women and youth have limited access to education, training and extension services than men.</p> <p>Women have less access to agricultural information, technology and knowledge.</p>
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth males and men in spraying.

	<ul style="list-style-type: none"> Increased productivity from IWM will improve access and availability of food for all genders.
VMGs issues and concerns in development, dissemination and scaling up	<ul style="list-style-type: none"> VMGs have limited access to productive resources such as land and chemical. Women and youth have limited access to education, training and extension services than men. Due to their social status VMGs are often excluded from decision making in development and dissemination activities. There is low adoption by VMGs due lack of awareness.
VMGs related opportunities	<ul style="list-style-type: none"> Employment opportunities exist for youth males in spraying.
E: Case studies/profiles of success stories	
Success stories	-Laikipia, Machakos Makueni growers
Application guidelines for users	North Carolina State Extension and training material available
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation.
G: Contacts	
Contacts	Center Director KALRO Kabete, Waiyaki Way, P.O Box 14733-00800, Nairobi
Lead organization and scientists	KALRO , Kabete Dr Hottensiah Mwangi, Dr Momanyi Violet .
Partner organizations	Kenya Seed Company, Faيدا Seed, Agrosoy seed, NGOs, CBO, County Governments, KEPHIS

2.7.14 TIMP Name	Mechanical weed control
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Poor crop establishment and reduction in yields due to weed infestation of annual and perennial grass and broadleaved weeds that compete with watermelon for resources such as nutrients.
What is it? (TIMP description)	Mechanical weed control is an effective weed management method that manages weed populations through physical/manual removal, injure, kill, or make the growing conditions unfavourable for growth by use hand held tools such as jembes to the most advanced vision-guided hoes. Other methods may alter the growing environment by eliminating light, increasing the temperature of the soil, or depriving the plant of carbon dioxide or oxygen. Land preparation is done using hoes or implements such as sub-soilers to kill weeds before planting. Hand hoeing may be used to control weeds in small-scale farming as it is less safe to use herbicides in home gardening due to the lack of training. Mechanical weed control can be applied as an intervention within the crop, and as a preventative measure as part of pre-season land preparation or as off-season dry-soil tillage. Preventive mechanical weed control options can be either off-season soil tillage between harvest and establishment of the next crop or land preparations prior to crop establishment that may include tillage, leveling, and puddling. Off-season dry-soil tillage at sufficient depth may help breaking and drying subsoil rhizomes of perennial weeds. Tillage in dry-soil tillage is often however too superficial to bury weed seeds or control perennial species. Timely manual weeding or hand pulling is done 2-3 weeks after germination followed by a second weeding 2 to 3 weeks later depending on the rate of re-growth.
Justification	If not controlled, weeds will take over, win the competition and cause significant yield losses of up to 100%. Delay in weeding which should be avoided will result into severe competition of growth resources with the crop. Mechanical weeding is usually more economical to use than manual labor because it involves the use of tillage implements like harrows, weeders, and cultivators driven by animals or engine. Implements bury or uproot weeds grown between

	crop rows which are wide enough to facilitate movement of the implements without significant injury to crops.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers and Agricultural extension service providers.
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, larger plot demonstrations. • MoAF&I/ Extension service providers • Partners (FAO, ICRISAT, Farm Inputs Promotions FIPs, County governments • Promotional materials (posters/ brochures/ leaflets, manuals, fact sheets) developed by KALRO, CABI/ Plantwise, MoAF&I.
Critical/ essential factors for successful promotion	<ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and release the technology for upscaling • Awareness creation and demonstrations on mechanical weed control watermelon through field days, farmer groups and FFSB approach • Training for users to build capacity on the technology. • Suitability of the TIMP to the agro-climatic and socio-economic condition of the farmer eg affordability of tools such as sub-soilers for tilling and harrowing. • A platform for interaction of cabbage value chain stakeholders for exchange of ideas
Partners/ stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Public and private partners such as MOALF&I for extension service, • 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, CBO, and FBOs to provide specialist services like community mobilization, nutrition training etc.
C: Current situation and future scaling up	
Counties where already promoted, if any	None
Counties where TIMP will be up scaled	All Counties growing melon
Challenges in dissemination	<ul style="list-style-type: none"> • Appropriate implements are not readily available in the market. • Low use of the technology because implements such as a sub-soiler are not readily available in the market. • Limited access to rural finance providers to assist purchase implements such as sub-soilers

	<ul style="list-style-type: none"> • Lack of melon innovation platforms to facilitate interaction of farmers with relevant stakeholder
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Work with Jua Kali industries for fabrication of appropriate implements like sub-soilers. • Link farmers to rural finance providers such as Equity bank to assist farmers financially
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Access and use of the technology will provide timely weed control which will enhance crop production. • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform • Creation of awareness through demonstrations and farmer field days help in adoption of the technologies • Availability of market for the produce is essential • Partnership facilitated through innovation platforms is important in technology dissemination • Access and use of appropriate weed management tools will provide timely weed control with reduced labour costs
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Sensitization of communities on mechanical weed management practice for sensitive young melon plants. • Cultivation of melon is socially acceptable • Market to absorb the increased production
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Labour cost for tilling and harrowing using a sub-soiler is about Ksh 30,000 per acre. Manual weeding is about KSH 12,000 per acre, 12 casuals per day@ Ksh 500 for 2 weedings). Total cost is about = 42,000
Estimated returns	Yield is about 20,000kg per acre @25 = Ksh 500,000 per acre (varies with variety). Estimated returns when weeding done manually is Ksh 500,000 - 42,000 = Ksh 464,500
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women perform most of the crops weeding activities therefore the management practice will reduce their work burden • Women and youth have limited access to credit to purchase the required implement. • 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 operation.
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. • VMGs have limited access to information on production techniques. There is low adoption by VMGs due lack of awareness.
VMGs related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for some VMGs such as women in performing the operation
E: Case studies/profiles of success stories	
Success stories	None.
Application guidelines for users	Manuals, brochures, fact sheets on integrated weed management developed by KALRO and CABI/ Plantwise. Available at; Training Manuals https://www.kalro.org Plantwise Knowledge Bank - CABI.org https://www.cabi.org
F: Status of TIMP Readiness (1. Ready for up-scaling; 2. Validation 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	Centre Director KALRO-Kabete, P.O. Box 14733-00800, NAIROBI. Tel: +254-0721822312, E-mail: cd.narl@kalro.org
Lead organization and scientists	KALRO, Hottensiah Mwangi, Violet N. Momanyi.
Partner organizations	MoALF in Counties

Research Gaps

Need to work out the cost benefit analysis which is important for upscaling mechanical weed control in melon

2.7.15 TIMP Name	Crop Rotation in Watermelon
Category (i.e. technology, innovation or management practice)	Management Practice

A: Description of the technology, innovation or management practice	
Problem addressed	High incidence of annual and perennial grass and broad leaved weeds combined with poor management practice that lead to high labour costs, low and poor quality yields in melon value chain.
What is it? (TIMP description)	Crop rotation is a planned sequence of growing different crops in succession on the same piece of land year after year to avoid exhausting the soil and to control weeds, pests, and diseases that may be specific to some crops. Land is divided into a number of distinct areas where the crops will be rotated every year. Keep together plants of same family such as vegetables, cereals, legumes. Melon is a heavy feeder and should follow legumes such as beans, dolichos and sorghums.
Justification	Rotation of crops with varied characteristics reduces the likelihood that specific weed species will become adapted to the cropping system and become problematic. The success of rotation systems is based on crop sequences that have varying patterns of resource competition, allelopathic interference, soil disturbance, and mechanical damage to particular weed species. The system minimizes weed population in current crop and reduces weed seed banks hence less future infestations. Different crops grown in rotation break the cycle of weeds which reduces weed diversity, prevalence and density. In addition, crop rotation adds diversity to the cropping system, increases sustainability, of the system and provides long term management of weeds.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers and Agricultural extension providers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, demonstrations on large plots. • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP)
Critical/ essential factors for successful promotion	<ul style="list-style-type: none"> • Participatory Implementation, stakeholder sensitization. • Applied and adaptive Research to test, validate and release rotation practice in melon varieties • A platform for interaction of melon 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 including MOALF&I to provide extension services,

	<ul style="list-style-type: none"> • Jua Kali artisans for provision of implements such as sub-soilers • 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, CBO, and FBOs to provide specialist services like community mobilization, nutrition training etc.
C: Current situation and future scaling up	
Counties where already promoted, if any	None
Counties where TIMP will be up scaled	All Counties growing melon
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of melon innovation platforms to facilitate interaction of farmers with relevant stakeholders • Low use of the technology • Small farms due to family subdivisions • Labour intensity at initial stages • Rotation schedules for melon not readily available.
Suggestions for addressing the challenges	Work with farmers to validate known schedules from other researchers or countries in different Watermelon growing regions.
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Use of appropriate crop rotation will provide timely weed control which will enhance crop production. • 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 technologies • Availability of market for the produce is essential • Partnership facilitated through innovation platforms is important in technology dissemination and adoption.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Sensitization of communities on the crop rotation practices in weed management
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Labour cost for tilling and harrowing using a sub-soiler is about Ksh 30,000 per acre. Manual weeding is about KSH 6,000 per acre, 6 casuals per day@ Ksh 500 for 2 weedings). Total cost is about = 36,000
Estimated returns	Yield is about 20,000kg per acre @20 = Ksh 500,000 per acre (varies with variety).

	Estimated returns when weeding done manually is Ksh 500,000 - 36,000 = Ksh 464,000
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Women perform most of the weeding activities therefore reduced weeds due to crop rotation will decrease s 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"> • Opportunities for women exist to perform other activities due to their reduced weeding workload.
VMG issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> • VMGs have limited access to education, training and extension services. • VMGs have less access to credit • 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 VMGs to access credit through affirmative action funds. • Increased production will improve food and nutrition security and economic empowerment of VMGs.
E: Case studies/profiles of success stories	
Success stories	None
Application guidelines for users	Production manuals on crop rotation for weed management TIMPs developed by KALRO, CABI/ Plantwise
F: Status of TIMP Readiness (1. Ready for up-scaling; 2. Validation 3. Requires further research)	1. Ready for up-scaling
G: Contacts	
Contacts	KALRO Kabete P.O. Box 14733-00800, Nairobi Email: cdnarl@kalro.org
Lead organization and scientists	KALRO, Hottensiah Mwangi, Violet Mumanyi.
Partner organizations	ICRISAT Nairobi MoALF@I Counties

2.7.47 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 to crops and the soil, spraying without wearing protective clothing, storage in non-designated areas, wrong application techniques,

	<p>spraying at the wrong times and against the wind, and use without following guidelines on the labels (including rate and Pre-Harvest Interval), wrong disposal of expired herbicides and empty containers, inadequate enforcement of global and national policies and regulation safe use of pesticides.</p>
What is it? (TIMP description)	<p>A management practice that includes methodologies for proper herbicide handling, application, and disposal of left overs and containers in a safe way in order to minimize pollution of the environment and contamination of the produce. Capacity building of farmers, crop protection spray 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 person handling them and the environment at large.</p>
Justification	<p>Cases of improper and misuse use of pesticides are very common in most of the areas where crops is grown yet they are not documented. There have been incidences of excessive use, improper handling that lead to the spray operators inhaling the chemicals in the process of spraying, use of inappropriate spray equipment that lead to leakages and thereby exposing 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. Increase of chronic diseases in human beings resulting from pesticide exposure has been reported.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Agro-dealers, farmers and herbicide applicators • Extension service providers to use for training farmers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Farmer field and business Schools (FFBS) • Agricultural Innovation Platforms (AIP) • Farmer trainings through participatory, demonstrations, field days, shows, trade fairs, plant clinics, demonstrations on pesticide spraying.
Critical/ essential factors for successful promotion	<ul style="list-style-type: none"> • Collaboration between all partners, willingness of farmers to adhere to proper guidelines. • Adequate facilitation: funds, logistics (transport) <ul style="list-style-type: none"> • Applied and adaptive Research to test, validate and employ safe use of herbicides in melon production • A platform for interaction of melon value chain stakeholders

	<ul style="list-style-type: none"> • Collaboration between all partners, willingness of farmers to adhere to proper guidelines. • Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers, farmer groups/CBO to participate in the implementation of the various technologies for watermelon production, • KALRO and Universities to develop the technologies and conduct ToTs. AAK, PCPB, KEPHIS.
C: Current situation and future scaling up	
Counties where already promoted, if any	None
Counties where TIMPS will be up scaled	All Counties where farmers use pesticides in crop production
Challenges in dissemination	<ul style="list-style-type: none"> • Change of mindset in favour of current practices maybe difficult to achieve. • Due to illiteracy most farmers cannot read and interpret information on labels which results into overuse or underuse. • Use of banned herbicides smuggled from neighboring countries • Inadequate capacity by farmers and agrochemical companies to dispose expired herbicides. • Lack of melon innovation platforms for interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building and sensitization forums for both farmers and agro dealers on safe use of chemicals. • Formation of youth spray teams to spray at a fee. • Establishment of training of Extension staff and lead farmers as TOT. • Establish melon innovation platforms • Capacity building and sensitization forums for both farmers and agro dealers using participatory approach. • Establishment of aggregation centres for the disposal of pesticide containers • Increase surveillance along the border points and enforce the laws to prevent smuggling in of unregistered herbicides.
Lessons learned in upscaling if any	<ul style="list-style-type: none"> • Upscaling of this technology needs young men and youth to do the spraying and collection of empty containers. • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an

	<p>innovation platform</p> <ul style="list-style-type: none"> • Creation of awareness through demonstrations and farmer field days help in adoption of technologies • Availability of registered herbicides is essential • Partnership facilitated through innovation platforms is important in technology dissemination and adoption • Consumers concerns of herbicide residues in the soil and subsequent crops needs attention • 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	<ul style="list-style-type: none"> • Address the environmental and social concerns related to use of agrochemicals by developing a safety action plan. • A functional agro-dealer frameworks, policies and network to supply registered herbicides when required by the farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of a complete set of protective clothing is approximately KES 5,000
Estimated returns	Not applicable. The TIMP takes care of the herbicide applicator, consumer and environment.
Gender issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> • The management practice is not user friendly to women especially expectant mothers • Women and youth have limited access to education, training and extension services than men. • Women have less access to agricultural information, technology and knowledge. • Women and youth may have less access to credit to purchase protective clothing and chemicals
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth males and men in spraying
VMGs issues and concerns in development and dissemination	<ul style="list-style-type: none"> • The management practice is not user friendly to women especially expectant mothers • Some VMGs such as those abled differently and the elderly may have less access to credit to purchase protective clothing and 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.
VMGs related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for youth males and men in spraying
E: Case studies/profiles of success stories	

Success stories	<ul style="list-style-type: none"> • The AAK has trained youth spraying teams that have helped in the spraying of the 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	<ol style="list-style-type: none"> 1. Momanyi Violet (2017). Guidelines for Safe and Effective Use of Pesticides: Safety Measures for Pesticide Users. A hand book published by Lap Lambert Academic Publishing. Available at: https://www.amazon.com/Guidelines-Safe-Effective-Use-Pesticides/dp/6202006218 2. Manuals, brochures, fact sheets on integrated weed management developed by KALRO and CABI/ Plantwise Training Manuals https://www.kalro.org Plantwise Knowledge Bank - https://www.cabi.org
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	1. 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 and scientists	KALRO: Hottensiah Mwangi, Violet Momanyi.
Partner organizations	MoALF&I CABI PCPB AAK KEPHIS County Governments Universities

Research Gaps

Need to work out the cost benefit analysis which is important for upscaling on safe use of herbicides.

Herbicides are misused and wrongly used many times. There is need to educate stakeholders on the risks.

2.8 Integrated Management Of Watermelon Diseases

2.8.1 TIMP name	Integrated Management of Anthracnose disease in Watermelons
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<p>Yield loss of upto 69% due to infection of Watermelon by the disease</p> <div> </div> <p style="text-align: center;">Anthracnose on watermelon fruit Source: Lusike Wasilwa-KALRO</p>
What is it? (TIMP description)	<p>Integrated management of anthracnose applies various approaches in management of the diseases. They include: cultural and chemical control.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Use certified seeds • Practice crop rotation with non-legumes. • Work in uninfected parts of the field first before the infected area. • Avoid unnecessary movement in infected areas to minimize spread of the disease, disinfect farm implements after working from one field before proceeding to the other. • Hot water treatment of Watermelons at 54° for 10min. <p>Chemical management:</p> <ul style="list-style-type: none"> • Applying fungicides from flower-bud formation stage until when pods are fully developed. The most susceptible stage is bud-formation, flowering period and early pod development. • Spraying Carbendazim 500g or Mancozeb 2kg/ha soon after the appearance of disease and repeat after 15 days.

	<ul style="list-style-type: none"> • Spraying other fungicides such as Copper based fungicides e.g. Cuprocaffaro WP, Trifloxystrobin + Tebuconazole based fungicides e.g. Nativo 300 SC or Carbendazim based fungicides e.g. Rodazim SC in strict adherence to manufacturer's instructions.
Justification	Anthracnose causes up to 69% yield losses and reduces market quality of Watermelons in Kenya. Losses occasioned by the diseases lead to reduced returns for the farmers and negatively impacts on food and national security of the country. Integrated Disease Management practices for this disease have the ability to lower the total cost of production, reduce pesticide-related risk exposure to farmers and conserve environmental biodiversity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, Exporters, Farmers, Processors, Extension service providers, Researchers, Academia
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural Innovation Platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Carry out Applied and adaptive research to validate and release improved Watermelon varieties • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators • CGIAR • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers

C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo
Counties where TIMPs will be upscaled	West Pokot and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Farmers are not receptive to cultural methods of managing diseases e.g. Crop rotation is difficult to implement for farmers with small land holdings and limited economic resources. • Limited knowledge by farmers on integrated disease management practices • Few farmer groups • Lack of Watermelon Innovation Platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides • Promote appropriate marketing channels e.g. contract farming, collective production and marketing
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • More than one approach is used in management of the disease. • IDM is environment friendly and the chemical component should be used judiciously as the last resort • Participatory, farmer-centered approaches, which encourage farmers to participate in the innovation process and the facilitation of experimentation among farmer communities in the evaluation of the management practice enhances adoption
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure fungicides sold to farmers are genuine and of high quality • Producers willing to adopt the disease management practices • Producers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers. • 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 • Market able to absorb increased supply of grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 5,000

Estimated returns	Approximately Ksh 200,000. If IDM of anthracnose is not applied the yield will be reduced by 69%. Therefore, the estimated returns will be 200,000-138,000= Ksh 62,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for Anthracnose due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used to for IDM for Anthracnose because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for Anthracnose • IDM for Anthracnose is cheap and reduces production costs therefore user friendly to poor women • Where IDM for Anthracnose will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IDM for Anthracnose will lead to improved productivity of watermelon hence more income for women • Adoption of IDM for Anthracnose will also lead to increased food security and nutrition for households • IDM adoption for Anthracnose will lead to employment opportunities for women and youth at various nodes of watermelon value chain • There will also a reduction of cost of production for women if IDM for Anthracnose is adopted.
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 agricultural information and extension so they might not be aware of IDM for Anthracnose • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM for Anthracnose will lead to improved productivity of watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • There will also a reduction of cost of production for VMGs if IDM of Anthracnose is adopted.


E: Case studies/profiles of success stories

Success stories	-
Application guidelines for users	<ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	<p>Centre Director KALRO Kabete, P.O. Box 14733 00800 NBI cd.narl@kalro.org Phone: 0727624471</p> <p>Centre Director KALRO-Perkerra P.O. Box 32-30403, MARIGAT</p>
Lead organization and scientists	KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo
Partner organizations	Extension service providers, ICRAF, CABI, KEPHIS, FPEAK, FAO, NGOs

Research Gaps:

1. Explore Bio-control option for pests and diseases
2. Explore the use of ITK's in disease management

2.8.2 TIMP name	Integrated Management of Powdery mildew disease in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	

Problem addressed	<p>Yield loss of between 25% due to Watermelon infection by the disease</p>  <p>Powdery mildew on leaves (Source: Lusike Wasilwa-KALRO)</p>
What is it? (TIMP description)	<p>Integrated management of powdery mildew applies a combination of several approaches to break the disease cycle. These include: cultural management and chemical control.</p> <p>Cultural management options:</p> <ul style="list-style-type: none"> • Plant early using certified seeds. • Practice crop rotation with non-cucubitaceae for a period of 2-3 seasons. • Uproot and destroy severely affected plants, including weeds and volunteer crops by burying them deeply. • Do not walk through your field during wet weather to prevent the spread of the disease from one plant to another. • Ensure that field sanitation and hygiene practices are adhered to by collecting and disposing infected plants by deeply burying them. <p>Chemical management options:</p> <ul style="list-style-type: none"> • Spraying copper based products such as copper oxychloride (cuprocaffaro micro 37.5 at a rate of 50 gm/20 litres water or Isacop 50WP at a rate of 60 g/20 litres of water) once initial symptoms are observed.
Justification	<p>Powdery mildew is one of the major diseases affecting Watermelon production in Kenya. Losses of up to 25% have been experienced. Integrated management is an effective management package against Powdery mildew which considers food safety concerns related to pesticide use and advocates for environmental conservation while lowering the total cost of Watermelon production.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Exporters, Processors, Extension service providers, Researchers, Academia
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, seminars and meetings • Field days • Agricultural shows

	<ul style="list-style-type: none"> • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Undertake applied and adaptive research to validate and release improved Watermelon varieties • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices. • Have well organized farmer groups and networks. • Strong partnership linkages • Need for farmer involvement helps generate locally specific techniques and solutions suitable for their particular farming systems and integrating control components that are ecologically sound and readily available to them e.g. Use of Indigenous Traditional Knowledge (ITK) can be promoted and adopted faster. • Accessibility and cost of the practice by farmers: low-cost agricultural practices are easily promoted and accepted
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continue undertaking research in disease management • KEPHIS to ensure the quality of seedlings is maintained • PCPB to promote registration of fungicides for management of the disease and regulate the use of pesticides • Farmers/farmer groups to adopt these technologies • County governments, central governments develop enabling policies and create awareness. • Financial institutions to provide credit facilitators • Private pesticide companies to promote and sell registered pesticides
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo,
Counties where TIMPs will be upscaled	West Pokot and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Limited number of extension staff • Limited Watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders. • Farmers may not implement some of the practices e.g. Crop rotation small farms and limited economic resources.


Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disseminate and promote integrated disease management practices and safe use of pesticides • Establish spray teams/champions • Support extension services • Training on integrated disease management practices (use of clean seed, field sanitation, crop rotation, biological control, tolerant varieties and use of ITK's) in managing the disease.
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Successful scaling up is possible if diverse value chain stakeholders collaborate in an innovation platform • Adoption of good agricultural practices by the producers is key in management of the diseases • More than one approach is used in management of major diseases • IDM is environment friendly and the chemical component should be used as the last resort • Participatory, farmer-centered approaches, which encourage farmers to participate in the innovation process and the facilitation of experimentation among farmer communities in the evaluation of the technology enhances technology adoption • IDM approaches are knowledge intensive and location-specific, farmers would need to understand the agro-ecological processes affecting the disease to be able to make informed decisions on how to manage crop to avoid disease occurrence, as well as how to manage the diseases once they become a problem.
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure fungicides sold to farmers are genuine and of high quality. • Farmers' willingness to adopt the disease management practices • Farmers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers. • 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 • Market able to absorb increased supply of grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 6,000
Estimated returns	Approximately Ksh 200,000. If IDM of powdery mildew is not applied the yield will be reduced by 25%. Therefore, the estimated returns will be 200,000-50,000= Ksh 150,000

Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for Powdery mildew due to lack of access to agricultural information and extension services • Women and youth might not be able to purchase the chemical used for Powdery mildew IDM because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for Powdery mildew • IDM for Powdery mildew is cheap and reduces production costs therefore user friendly to poor women • Where IDM for Powdery mildew will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IDM for Powdery mildew will lead to improved productivity of Watermelon hence more income for women • Adoption of IDM for Powdery mildew will also lead to increased food security and nutrition for households • IDM adoption for Powdery mildew will lead to employment opportunities for women and youth at various nodes of Watermelon value chain • There will also a reduction of cost of production for women if IDM for Powdery mildew is adopted.
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 agricultural information and extension so they might not be aware of IDM for Powdery mildew • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM for Powdery mildew will lead to improved productivity of Watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • There will also a reduction of cost of production for VMGs if IDM for Powdery mildew is adopted.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	References:

	<ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p> <p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo
Partner organizations	ICRAF, CABI, KEPHIS Extension service providers, CGIAR, NGOs

Research Gaps:

1. Explore Bio-control options for the disease
2. Explore the use of ITKs in disease management at different stages of the disease

2.8.3 TIMP name	Integrated Management of <i>Alternaria</i> leaf spot disease in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	<p>Yield loss of up to 40% due to infection of Watermelon by the disease</p>  <p style="text-align: center;"><i>Alternaria</i> leaf spot disease (Source: growingproduce.com)</p>
What is it? (TIMP description)	<p>Integrated disease management of <i>Alternaria</i> leaf spot applies cultural management practices, deployment of tolerant varieties and chemical control in the management of the disease in Watermelon.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Practice good field sanitation and hygiene practices by collecting and safely disposing infected plants. • Regular weeding <p>Grow tolerant varieties:</p> <ul style="list-style-type: none"> • Grow varieties that are less susceptible to the disease such as KAT60/80 and Mbaazi 2. <p>Chemical management:</p> <ul style="list-style-type: none"> • Spray Mancozeb based products (Oshothane or Farmcozeb at 2kg/ha or Carbendazim 500 g/ha.
Justification	<p><i>Alternaria</i> leaf spot is one of the major diseases affecting Watermelon production in Kenya. Losses of up to 40% have been experienced. Integrated management is an effective management package against <i>Alternaria</i> leaf spot which considers food safety concerns related to pesticide use and advocates for environmental conservation while lowering the total cost of Watermelon production.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, Exporters, Farmers, Processors, Extension service providers, Researchers, Academia

Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, seminars, meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Farmer involvement will be necessary for successful implementation of the IDM package. • Use of Indigenous Traditional Knowledge (ITK) can be promoted and adopted faster. • Accessibility and cost of the practice by farmers: low-cost agricultural practices are easily promoted and accepted
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 • CGIAR's • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers • County governments-Help in the dissemination of the technology
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo
Counties where TIMPs will be upscaled	West Pokot and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Few farmer group organizations • Lack of Watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Hold mass campaigns to create awareness on integrated disease management practices and safe use of pesticides
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Foster more Partnership in technology dissemination and adoption through innovation platforms

	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the farmers in management of diseases
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure pesticides being used by farmers are genuine and are of high quality • Farmer's willingness to adopt the disease management practices • Farmers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers. • 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 • Market able to absorb increased supply of grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 4,500
Estimated returns	Approximately Ksh 200,000. If IDM of <i>Alternaria</i> leaf spot is not applied the yield will be reduced by 40%. Therefore, the estimated returns will be 200,000-80,000= Ksh 120,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for <i>Alternaria</i> leaf spot due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IDM for <i>Alternaria</i> leaf spot because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for <i>Alternaria</i> leaf spot • IDM for <i>Alternaria</i> leaf spot is cheap and reduces production costs therefore user friendly to poor women • Where IDM for <i>Alternaria</i> leaf spot will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IDM for <i>Alternaria</i> leaf spot will lead to improved productivity of Watermelon hence more income for women • Adoption of IDM for <i>Alternaria</i> leaf spot will also lead to increased food security and nutrition for households


	<ul style="list-style-type: none"> • IDM adoption for <i>Alternaria</i> leaf spot will lead to employment opportunities for women and youth at various nodes of Watermelon value chain • There will also a reduction of cost of production for women if IDM for <i>Alternaria</i> leaf spot is adopted.
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 agricultural information and extension so they might not be aware of IDM for <i>Alternaria</i> leaf spot • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM for <i>Alternaria</i> leaf spot will lead to improved productivity of Watermelon hence more income for VMGs • IDM adoption for <i>Alternaria</i> leaf spot will lead to employment opportunities for some VMGs such as youth in spraying • There will also a reduction of cost of production for VMGs if IDM of <i>Alternaria</i> leaf spot is adopted.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (1-Ready for upscaling, 2-	Ready for upscaling

requires validation, 3-requires further research)	
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p> <p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo
Partner organizations	Extension service providers, ICRAF, CABI, KEPHI, FPEAK, FAO, NGOs

Research Gaps:

1. Explore Bio-control options for disease
2. Explore the use of ITKs in disease management

2.8.4 TIMP name	Integrated Management of Cucumber Mosaic Viral disease in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	

<p>Problem addressed</p>	<p>Yield loss of between 30 -40% due to infection of Watermelon by the disease</p>  <p>Cucumber mosaic virus symptoms on leaves Source: growveg.com</p>
<p>What is it? (TIMP description)</p>	<p>Integrated management of Cucumber Mosaic Viral disease of Watermelons is the combined application of cultural and chemical management practices against the disease. The virus is transmitted by White flies (<i>Bemisia tabaci</i>) as they suck sap from plant tissues.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Use of certified seed • Monitoring and control of vectors (White flies) that transmit the viruses • Avoiding work on fields when wet to prevent spread • Uprooting weeds that could serve as alternative hosts <p>Chemical management:</p> <ul style="list-style-type: none"> • Treat the seeds with CELEST TOP 312 FS Flowable Concentrate, MARSHAL 350 STD Dry seed treatment • Spray Thiamethoxam-25WG @ 100g or Imidacloprid 17.8% SL @ 100 ml in 500 lit of water. • Get other control products from the PCPB (www.pcpb.or.ke) list of registered pest control products, and use them according to the manufacturer's instructions.
<p>Justification</p>	<p>Cucumber Mosaic virus is one of the major diseases affecting Watermelon production. Losses of up to 40% have been experienced. Integrated management of the disease is an effective management package against the disease. It is an environmental friendly approach that enables the control of the disease through control of vectors.</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Producers, Exporters, Researchers, Academia, Farmers</p>
<p>Approaches to be used in dissemination</p>	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, seminars, meetings • Field days • Agricultural shows • MoA/Extension officers

	<ul style="list-style-type: none"> • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Carry out Applied and adaptive research to validate and release improved Watermelon varieties • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Accessibility and cost of the practice by farmers: low-cost agricultural practices are easily promoted and accepted
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo,
Counties where TIMPs will be upscaled	West Pokot and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of Extension agents • Lack of Watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders • Farmers may not implement some of the practices e.g. Crop rotation small farms and limited economic resources.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides in Watermelon production • Dissemination of agronomic practices • Training on integrated disease management practices (use of clean seed, field sanitation, crop rotation, biological control, tolerant varieties and use of ITK's) in managing the disease.

Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms • Adoption of good agricultural practices by the producers is key in management of the diseases
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure fungicides sold to farmers are genuine and of high quality. • Farmer's willingness to adopt these disease management practices • Farmers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers. • 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 • Market able to absorb increased supply of grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 5,500
Estimated returns	Approximately Ksh 200,000. If IDM of Cucumber Mosaic Viral disease is not applied the yield will be reduced by 40%. Therefore, the estimated returns will be 200,000-80,000= Ksh 120,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for Cucumber Mosaic virus due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used to for IDM for Cucumber Mosaic virus because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for Cucumber Mosaic virus • IDM for Cucumber Mosaic virus is cheap and reduces production costs therefore user friendly to poor women • Where IDM for Cucumber Mosaic virus will involve mulching it will add more work to women who are already burdened by their domestic roles


Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • • Adoption of IDM for Cucumber Mosaic virus will lead to improved productivity of Watermelon hence more income for women • Adoption of IDM for Cucumber Mosaic virus will also lead to increased food security and nutrition for households • IDM adoption for Cucumber Mosaic virus will lead to employment opportunities for women and youth at various nodes of Watermelon value chain • There will also a reduction of cost of production for women if IDM for Cucumber Mosaic virus is adopted.
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 agricultural information and extension so they might not be aware of IDM for Cucumber Mosaic virus. • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM will lead to improved productivity of Watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • There will also a reduction of cost of production for VMGs if IDM for Cucumber Mosaic virus is adopted..
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash

	Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p> <p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo
Partner organizations	Extension service providers, ICRAF, CABI, CGIAR's, NGOs, County governments

Research Gaps:

1. Explore bio-pesticide options for insect vector management
2. Explore the use of ITKs in disease management

2.8.5 TIMP name	Integrated Management of Yellow Mosaic Viral disease in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss of between 30 -40% due to infection of Watermelon by the disease


	 <p>Yellow mosaic symptoms on leaf (Source: researchgate.net)</p>
<p>What is it? (TIMP description)</p>	<p>Integrated management of Yellow Mosaic Viral disease of Watermelons is the combined application of cultural and chemical management practices against the disease. The virus is transmitted by White flies (<i>Bemisia tabaci</i>) as they suck sap from plant tissues.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Use of certified seed • Monitoring and control of vectors (White flies) that transmit the viruses • Avoiding work on fields when wet to prevent spread • Uprooting weeds that could serve as alternative hosts <p>Chemical management:</p> <ul style="list-style-type: none"> • Treat the seeds with CELEST TOP 312 FS Flowable Concentrate, MARSHAL 350 STD Dry seed treatment • Spray Thiamethoxam-25WG @ 100g or Imidacloprid 17.8% SL @ 100 ml in 500 lit of water. • Get other control products from the PCPB (www.pcpb.or.ke) list of registered pest control products, and use them according to the manufacturer's instructions.
<p>Justification</p>	<p>Yellow Mosaic virus is one of the major diseases affecting Watermelon production. Losses of up to 40% have been experienced. Integrated management of the disease is an effective management package against the disease. It is an environmental friendly approach that enables the control of the disease through control of vectors.</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Producers, Exporters, Researchers, Academia, Farmers</p>
<p>Approaches to be used in dissemination</p>	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, seminars, meetings • Field days • Agricultural shows • MoA/Extension officers • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs

	<ul style="list-style-type: none"> • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Carry out Applied and adaptive research to validate and release improved Watermelon varieties • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices • Form well organized farmer groups and networks • Accessibility and cost of the practice by farmers: low-cost agricultural practices are easily promoted and accepted
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo,
Counties where TIMPs will be upscaled	West Pokot and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated pest management • Limited number of Extension agents • Lack of Watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders • Farmers may not implement some of the practices e.g. Crop rotation small farms and limited economic resources.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides in Watermelon production • Dissemination of agronomic practices • Training on integrated disease management practices (use of clean seed, field sanitation, crop rotation, biological control, tolerant varieties and use of ITK's) in managing the disease.
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms

	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the diseases
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure fungicides sold to farmers are genuine and of high quality. • Farmer's willingness to adopt these disease management practices • Farmers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers. • 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 • Market able to absorb increased supply of grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 5,500
Estimated returns	Approximately Ksh 200,000. If IDM of Yellow Mosaic virus is not applied the yield will be reduced by 40%. Therefore, the estimated returns will be 200,000-80,000= Ksh 120,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for Yellow Mosaic virus due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used to for IDM for Yellow Mosaic virus because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for Yellow Mosaic virus • IDM for Yellow Mosaic virus is cheap and reduces production costs therefore user friendly to poor women • Where IDM for Yellow Mosaic virus will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • • Adoption of IDM for Yellow Mosaic virus will lead to improved productivity of Watermelon hence more income for women

	<ul style="list-style-type: none"> • Adoption of IDM for Yellow Mosaic virus will also lead to increased food security and nutrition for households • IDM adoption for Yellow Mosaic virus will lead to employment opportunities for women and youth at various nodes of Watermelon value chain • There will also a reduction of cost of production for women if IDM for Yellow Mosaic virus is adopted.
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 agricultural information and extension so they might not be aware of IDM for Yellow Mosaic virus. • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM will lead to improved productivity of Watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • There will also a reduction of cost of production for VMGs if IDM for Yellow Mosaic virus is adopted..
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for upscaling

G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p> <p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	<p>KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo</p>
Partner organizations	<p>Extension service providers, ICRAF, CABI, CGIAR's, NGOs, County governments</p>

2.8.6 TIMP name	Integrated Management of Phytophthora blight in Watermelons
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<p>Yield loss of 60% due to infection of Watermelon by the disease</p>  <p>Phytophthora blight of Watermelons (Source; semanticscholar.org)</p>
What is it? (TIMP description)	<p>Integrated management of Phytophthora blight applies cultural and chemical practices to manage the disease.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Crop rotation with non-legumes for a period of 2 to 3 seasons • Rogueing out infected plants from the farm and burying then deeply.

	<ul style="list-style-type: none"> • Good drainage in the fields and the plants should be protected from stem injury; • Crop rotation should be followed; • Avoidance of working in the fields when plants are wet to minimize spread. • Disinfecting farm tools in jik solution (50 ml: litre). • Practicing good field sanitation and hygiene practices by collecting and disposing infected plants. <p>Chemical management:</p> <ul style="list-style-type: none"> • Seed treated with Metalaxyl 35 WS @3 g/ kg of seed • Get other control products from the PCPB (www.pcpb.or.ke) list of registered pest control products, and use them according to the manufacturer’s instructions.
Justification	Phytophthora blight disease is a major challenge in Watermelon production in Kenya, occurring in all major production areas, but being more severe in some regions. Integrated Disease Management is an environmental friendly approach that enables the control of the disease and cultural practises that prevent on farm spread hence reducing yield loss.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, Exporters, Farmers, Processors, Extension service providers, Researchers, Academia
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps generate locally specific techniques and solutions suitable for their particular farming systems and integrating control components that are ecologically sound and readily available to them e.g. Use of Indigenous Traditional Knowledge (ITK) can be promoted and adopted faster. • Accessibility and cost of the practice by farmers: low-cost agricultural practices are easily promoted and accepted
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management

	<ul style="list-style-type: none"> • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo
Counties where TIMPs will be upscaled	West Pokot and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	Farmers may not implement some of the practices e.g. Crop rotation small farms and limited economic resources.
Suggestions for addressing the challenges	Training on integrated disease management practices (use of clean seed, field sanitation, crop rotation, biological control, tolerant varieties and use of ITK's) in managing the disease.
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • More than one approach is used in management of major diseases • IDM is environment friendly and the synthetic chemical component should be used as the last resort • Participatory, farmer-centered approaches, which encourage farmers to participate in the innovation process and the facilitation of experimentation among farmer communities in the evaluation of the technology enhances technology adoption • IDM approaches are knowledge intensive and location-specific, farmers would need to understand the agro-ecological processes affecting the disease to be able to make informed decisions on how to manage crop to avoid disease occurrence, as well as how to manage the diseases once they become a problem. This will require a capacity building on crop monitoring and ecological principles.
Social, environmental, policy and market conditions necessary for development and up scaling	<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 • Market able to absorb increased supply of grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 3,500


Estimated returns	Approximately Ksh 200,000. If IDM of Phytophthora blight is not applied the yield will be reduced by 60%. Therefore, the estimated returns will be 200,000-120,000= Ksh 80,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for Phytophthora blight due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used in IDM for Phytophthora blight because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for Phytophthora blight • IDM for Phytophthora blight is cheap and reduces production costs therefore user friendly to poor women • Where IDM for Phytophthora blight will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IDM for Phytophthora blight will lead to improved productivity of Watermelon hence more income for women • Adoption of IDM for Phytophthora blight will also lead to increased food security and nutrition for households • IDM adoption for Phytophthora blight will lead to employment opportunities for women and youth at various nodes of Watermelon value chain • There will also a reduction of cost of production for women if IDM for Phytophthora blight is adopted.
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 agricultural information and extension so they might not be aware of IDM for Phytophthora blight • VMGs lack finances due to limited access to credit facilities they might not be able to purchase some of the chemicals used for control of Watermelon diseases
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM for Phytophthora blight will lead to improved productivity of Watermelon hence more income for VMGs

	<ul style="list-style-type: none"> • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • • There will also a reduction of cost of production for VMGs if IDM for Phytophthora blight is adopted.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>References:</p> <p>Esilaba, A.O.<i>et al.</i> (2021). KCEP-CRAL Watermelons Extension Manual. Kenya Agricultural and Livestock Research Organization, Nairobi, Kenya ISBN: 978-9966-30-036-2</p> <p>Reddy, M V and Raju, T N and Sharma, S B and Nene, Y L and McDonald, D and Pande, S and Sharma, M (2012) <i>Handbook of Pigeonpea Diseases (Revised). Information Bulletin No. 42.</i> Technical Report. International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh, India.</p>
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471
Lead organization and scientists	KALRO-Kabete, Ruth Amata., Daniel Mutisya., Nzioki C., Rael Karimi, Mercyline Orayo and Harun Odhiambo
Partner organizations	Extension service providers, CGIAR, CABI, ICRAF

Research Gaps:

1. Explore Bio-control option for insect vector
2. Explore the use of ITKs in disease management

2.8.7 TIMP name	Integrated Management of Fusarium wilt in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Yield loss of 80% due to infection of Watermelon by the disease

	 <p>Fusarium attack on a Watermelon crop Source: plantpath.ifas.ufl.edu</p>
<p>What is it? (TIMP description)</p>	<p>Integrated management of Fusarium wilt applies cultural and chemical practices to manage the disease.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • A three-year crop rotation schedule with non legumes and the planting of resistant varieties is advised. • Field sanitation by removing or rouging infected plants and burning them should be done. • A soil sample analysis should be done before planting of Watermelons at each and every season. • Disinfecting farm tools in jik solution (50 ml: litre). <p>Chemical management:</p> <ul style="list-style-type: none"> • Suspected infected soils can be drenched with Carbendazim based products like Rodazim SC or Bendazim SC as per the manufacturers' recommendations.
<p>Justification</p>	<p>Fusarium wilt is one of the major diseases affecting Watermelon production in Kenya. Losses between 80% have been experienced. Integrated management of the disease is an effective management package against the disease. It involves the integration of various options including cultural, physical, biological and chemical options. Integrated Disease Management is an environmental friendly approach that enables the control of the disease through control of vectors and cultural practises that prevent on farm spread hence reducing yield loss.</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Producers, Exporters, Farmers, Processors, Extension service providers, Researchers, Academia</p>
<p>Approaches to be used in dissemination</p>	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer

	<ul style="list-style-type: none"> • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Need for farmer involvement helps generate locally specific techniques and solutions suitable for their particular farming systems and integrating control components that are ecologically sound and readily available to them e.g. Use of Indigenous Traditional Knowledge (ITK) can be promoted and adopted faster. • Accessibility and cost of the practice by farmers: low-cost agricultural practices are easily promoted and accepted
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo,
Counties where TIMPs will be upscaled	West Pokot and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Farmers may not implement some of the practices e.g. Crop rotation small farms and limited economic resources.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Training on integrated disease management practices (use of clean seed, field sanitation, crop rotation, biological control, tolerant varieties and use of ITK's) in managing the disease.
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • More than one approach is used in management of major diseases • IDM is environment friendly and the synthetic chemical component should be used as the last resort • Participatory, farmer-centered approaches, which encourage farmers to participate in the innovation process and the facilitation of experimentation among farmer communities in the evaluation of the technology enhances technology adoption


	<ul style="list-style-type: none"> • IDM approaches are knowledge intensive and location-specific, farmers would need to understand the agro-ecological processes affecting the disease to be able to make informed decisions on how to manage crop to avoid disease occurrence, as well as how to manage the diseases once they become a problem. This will require a capacity building on crop monitoring and ecological principles.
Social, environmental, policy and market conditions necessary for development and up scaling	<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 • Market able to absorb increased supply of grain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 4,000
Estimated returns	Approximately Ksh 200,000. If IDM of Fusarium wilt is not applied the yield will be reduced by 80%. Therefore, the estimated returns will be 200,000-160,000= Ksh 40,000
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for Fusarium wilt due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used to for IDM for Fusarium wilt because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for Fusarium wilt • IDM for Fusarium wilt is cheap and reduces production costs therefore user friendly to poor women • Where IDM for Fusarium wilt will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IDM for Fusarium wilt will lead to improved productivity of Watermelon hence more income for women • Adoption of IDM for Fusarium wilt will also lead to increased food security and nutrition for households • IDM adoption for Fusarium wilt will lead to employment opportunities for women and youth at various nodes of Watermelon value chain

	<ul style="list-style-type: none"> • There will also a reduction of cost of production for women if IDM for Fusarium wilt is adopted.
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 agricultural information and extension so they might not be aware of IDM for Fusarium wilt • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM for Fusarium wilt will lead to improved productivity of Watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • • There will also a reduction of cost of production for VMGs if IDM for Fusarium wilt is adopted.
E: Case studies/profiles of success stories	
Success stories	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (1-Ready for upscaling, 2-requires validation, 3-requires further research)	Ready for upscaling
G: Contacts	

Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p> <p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi. Email: fcrc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	<p>KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo</p>
Partner organizations	Extension service providers, CGIAR, CABI, ICRAF

Research Gaps:

3. Explore Bio-control option for insect vector
4. Explore the use of ITKs in disease management

2.8.8 TIMP Name	Integrated management of seedling blight (<i>Pythium</i>, <i>Rhizoctonia</i>) disease in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	<p>Yield loss of upto 60% due to watermelon seedling infection by the disease.</p>  <p>Melon seedlings infected with seedling blight (Source: apps.lucidcentral.org)</p>
What is it? (TIMP description)	<p>Integrated management of seedling blight consists of several approaches applied in an integrated manner to break the disease cycle. These include: cultural management and chemical control.</p> <p>Cultural management options:</p> <ul style="list-style-type: none"> • Plant early using certified seeds. • Use quality certified seeds.



	<ul style="list-style-type: none"> • Remove and destroy infected seedlings by burning, • Practice crop rotation with non-poaceae crops for a period of 2-3 seasons. • Ensure that field sanitation and hygiene practices are adhered to by collecting and safely disposing infected plants by deeply burying them. <p>Chemical control options:</p> <ul style="list-style-type: none"> • Dressed seeds with Imidacloprid based fungicides such as ‘Gaucho’, Thiamethoxam based products “Poncho”, Thiram based products “Moncerene” at recommended rates • Drench using carbenazim based products e.g. Rodazim or Mancozeb based products
Justification	Seedling blight is one of the major diseases affecting Watermelon production in Kenya. Losses between 40% have been experienced. Integrated management of Rust is an effective management package against the disease. It involves the integration of various options including cultural, physical, biological and chemical options.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, Exporters, Farmers, Processors, Extension service providers, Researchers, Academia.
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm demonstrations • Training workshops, Seminars, Meetings • Field days • Agricultural shows • MoA/Extension officers • Farmer to farmer • Mass media – Agricultural programs. • Promotional materials (posters/brochures/leaflets, manuals)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Carry out Applied and adaptive research to validate and release improved Watermelon varieties • Create a platform for interaction of Watermelon value chain stakeholders • Farmers adopt appropriate agronomic practices. • Form well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO to continually undertake research in disease management • KEPHIS to ensure seedling quality is maintained • PCPB to promote registration of fungicides for disease management • Farmers/farmer groups to adopt the technologies

	<ul style="list-style-type: none"> • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators. • Extension service providers (public and private) to help in the dissemination. • CGIARs • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be up scaled	West Pokot and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management practices • Few farmer groups • Lack of Watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Dissemination of integrated disease management practices and safe use of pesticides
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the disease. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in dissemination and adoption of the management practice and this can be facilitated through innovation platforms. • More than one approach is used in management of major diseases. • IDM is environment friendly and the chemical option should be used as the last resort • Participatory, farmer-centered approaches, which encourage farmers to participate in the innovation process and the facilitation of experimentation among farmer communities in the evaluation of the technology enhances technology adoption.
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the producers is key in management of the disease. • Chances of successful scaling are higher when many value chain stakeholders collaborate in an innovation platform • Partnership is important in dissemination and adoption of the management practice and this can be facilitated through innovation platforms.

	<ul style="list-style-type: none"> • More than one approach is used in management of major diseases. • IDM is environment friendly and the chemical option should be used as the last resort • Participatory, farmer-centered approaches, which encourage farmers to participate in the innovation process and the facilitation of experimentation among farmer communities in the evaluation of the technology enhances technology adoption.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 3,500
Estimated returns	Approximately Ksh 200,000. If IDM of seedling blight is not applied the yield will be reduced by 60%. Therefore, the estimated returns will be 200,000-120,000= Ksh 80,000
Gender issues and concerns in development , dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for seedling blight due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used to for IDM for seedling blight because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for seedling blight • IDM for seedling blight is cheap and reduces production costs therefore user friendly to poor women • Where IDM for seedling blight will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IDM for seedling blight will lead to improved productivity of Watermelon hence more income for women • Adoption of IDM for seedling blight will also lead to increased food security and nutrition for households • IDM adoption for seedling blight will lead to employment opportunities for women and youth at various nodes of Watermelon value chain • There will also a reduction of cost of production for women if IDM for seedling blight is adopted.
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

	<ul style="list-style-type: none"> • VMGs have limited access to agricultural information and extension so they might not be aware of IDM for seedling blight • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM for seedling blight will lead to improved productivity of Watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • • There will also a reduction of cost of production for VMGs if IDM for seedling blight is adopted.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p> <p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org</p>

	Phone: 0727624471 The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi. Email: fcr.muguga@kalro.org Tel: +254-0722219075
Lead organization and scientists	KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo
Partner organizations	Universities, MoALF


2.8.9 TIMP Name	Integrated management of Rind and Bud Necrosis in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	<p>Yield loss of up to 50% per due to infection of Watermelon seedlings by the disease</p>  <p>Watermelon Rind Necrosis</p>  <p>Watermelon Bud Necrosis Source: researchgate.net</p>

What is it? (TIMP description)	<p>Integrated management of Rind and Bud necrosis disease a combination of various cultural practices against the disease.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Control the thrips • Use disease free seeds • Avoid unnecessary handling of plants to limit the spread of the disease. • Plow-down or thoroughly compost field debris and cull piles after each growing cycle • Maintaining a clean buffer zone free of weeds of at least 25 m between a virus source and a susceptible crop can considerably reduce virus levels.
Justification	<p>Rind and Bud Necrosis is one of the major fruit diseases affecting Watermelon production. Losses of up to 50% have been experienced. Integrated management of Rind and Bud Necrosis is an effective management package against the disease. It involves the integration of various options including cultural, physical, biological and chemical options.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, Exporters, Farmers, Processors, Extension service providers, Researchers, Academia
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, seminars, meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Farmer involvement will be necessary for successful implementation of the IDM package. • Use of Indigenous Traditional Knowledge (ITK) can be promoted and adopted faster. • Accessibility and cost of the practice by farmers: low-cost agricultural practices are easily promoted and accepted
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 • CGIAR's • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers

	<ul style="list-style-type: none"> County governments-Help in the dissemination of the technology
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	Marsabit and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> Limited knowledge by farmers on integrated disease management Few farmer group organizations Lack of Watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Establish Watermelon innovation platforms Hold mass campaigns to create awareness on integrated disease management practices and safe use of pesticides
Lessons learned in upscaling, if any	<ul style="list-style-type: none"> Establish Watermelon innovation platforms Foster more Partnership in technology dissemination and adoption through innovation platforms. Adoption of good agricultural practices by the farmers in management of diseases
Social, environmental, policy and market conditions necessary for development and upscaling.	<ul style="list-style-type: none"> Regulatory bodies e.g. PCPBP, KBS to ensure pesticides being used by farmers are genuine and are of high quality Farmer's willingness to adopt the disease management practices Farmers are organized in groups to ensure that management practices are effectively up-scaled Farm input costs are within the reach of farmers. 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 Market able to absorb increased supply of grains
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(labour) Ksh 1,000
Estimated returns	Approximately Ksh 200,000. If IDM of Rind and Bud necrosis disease is not applied the yield will be reduced by 50%. Therefore, the estimated returns will be 200,000-100,000= Ksh 100,000
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women and youth have limited knowledge on IDM for Rind and Bud Necrosis due to lack of access to agricultural information and extension services

	<ul style="list-style-type: none"> • Women and youth might not be able purchase the chemical used to for IDM for Rind and Bud Necrosis because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for Rind and Bud Necrosis • IDM for Rind and Bud Necrosis is cheap and reduces production costs therefore user friendly to poor women • Where IDM for Rind and Bud Necrosis will involve mulching it will add more work to women who are already burdened by their domestic roles .
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IDM for Rind and Bud Necrosis will lead to improved productivity of Watermelon hence more income for women • Adoption of IDM for Rind and Bud Necrosis will also lead to increased food security and nutrition for households • IDM adoption for Rind and Bud Necrosis will lead to employment opportunities for women and youth at various nodes of Watermelon value chain • There will also a reduction of cost of production for women if IDM for Rind and Bud Necrosis is adopted.
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 agricultural information and extension so they might not be aware of IDM for Rind and Bud Necrosis • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM for Rind and Bud Necrosis will lead to improved productivity of Watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • There will also a reduction of cost of production for VMGs if IDM for Rind and Bud Necrosis is adopted.

E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP Readiness (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
F: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p> <p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi. Email: frc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo
Partner organizations	MoALF, ICRAF, CABI


2.8.10 TIMP Name	Integrated management of Bacterial Fruit Blotch disease in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	<p>Yield loss of up to 50% per due to infection of Watermelon seedlings by the disease</p>  <p style="text-align: center;">Source: greenlife.co.ke</p>
What is it? (TIMP description)	<p>Integrated management of Bacterial Fruit Blotch disease encompasses the use of various approaches in management of the diseases. They include: cultural and chemical practices.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Use disease free seeds • Providing good drainage (raised beds, properly graded fields). • Maintain low humidity and eliminate free water using sub-irrigation of flats to control spread of the bacterium. • Avoid overhead irrigation. • Do not handle plants while the foliage is wet. • Segregate seedlots to reduce the chance of lot-to-lot. • Avoid unnecessary handling of plants to limit the spread of the disease. • Plow-down or thoroughly compost field debris and cull piles after each growing cycle <p>Chemical management:</p> <ul style="list-style-type: none"> • Apply etridiazole and metalaxyl; benomyl, mancozeb, maneb, and thiophanate methyl based fungicides at recommended rates.
Justification	<p>Bacterial Fruit Blotch is one of the major fruit diseases affecting Watermelon production. Losses of up to 90% have been experienced. Integrated management of Bacterial Fruit Blotch is an effective management package against the disease. It involves the integration of various options including cultural, physical, biological and chemical options.</p>

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, Exporters, Farmers, Processors, Extension service providers, Researchers, Academia
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, seminars, meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Farmer involvement will be necessary for successful implementation of the IDM package. • Use of Indigenous Traditional Knowledge (ITK) can be promoted and adopted faster. • Accessibility and cost of the practice by farmers: low-cost agricultural practices are easily promoted and accepted
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 • CGIAR's • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers • County governments-Help in the dissemination of the technology
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	Marsabit and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Few farmer group organizations • Lack of Watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Hold mass campaigns to create awareness on integrated disease management practices and safe use of pesticides
Lessons learned in upscaling, if any	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Foster more Partnership in technology dissemination and adoption through innovation platforms.

	<ul style="list-style-type: none"> • Adoption of good agricultural practices by the farmers in management of diseases
Social, environmental, policy and market conditions necessary for development and upscaling.	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure pesticides being used by farmers are genuine and are of high quality • Farmer's willingness to adopt the disease management practices • Farmers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers. • 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 • Market able to absorb increased supply of grains
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 5,500
Estimated returns	Approximately Ksh 200,000. If IDM of Bacterial Fruit Blotch disease is not applied the yield will be reduced by 50%. Therefore, the estimated returns will be 200,000-100,000= Ksh 100,000
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for Bacterial Fruit Blotch due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used to for IDM for Bacterial Fruit Blotch because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for Bacterial Fruit Blotch • IDM for Bacterial Fruit Blotch is cheap and reduces production costs therefore user friendly to poor women • Where IDM for Bacterial Fruit Blotch will involve mulching it will add more work to women who are already burdened by their domestic roles • .
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • doption of IDM for Bacterial Fruit Blotch will lead to improved productivity of Watermelon hence more income for women

	<ul style="list-style-type: none"> • Adoption of IDM for Bacterial Fruit Blotch will also lead to increased food security and nutrition for households • IDM adoption for Bacterial Fruit Blotch will lead to employment opportunities for women and youth at various nodes of Watermelon value chain • There will also a reduction of cost of production for women if IDM for Bacterial Fruit Blotch is adopted.
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 agricultural information and extension so they might not be aware of IDM for Bacterial Fruit Blotch • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM for Bacterial Fruit Blotch will lead to improved productivity of Watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying • There will also a reduction of cost of production for VMGs if IDM for Bacterial Fruit Blotch is adopted.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	References: <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura,

	R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP Readiness (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
F: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p> <p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi. Email: fcr.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo
Partner organizations	MoALF, ICRAF, CABI

2.8.10 TIMP Name	Integrated management of Damping off disease in Watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	<p>Yield loss of up to 50% per due to infection of Watermelon seedlings by the disease</p> 





	Watermelon seedling affected by Damping off disease Source: pnwhandbooks.org
What is it? (TIMP description)	<p>Integrated management of Damping off disease encompasses the use of various approaches in management of the diseases. They include: cultural, biological and chemical practices.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Use disease free seeds • Providing good drainage (raised beds, properly graded fields). • Plant when soil and air temperatures are favorable for rapid seedling emergence. <p>Biological</p> <ul style="list-style-type: none"> • Apply <i>Trichoderma</i> spp. and <i>Gliocladium</i> spp. or bacteria such as <i>Pseudomonas</i> spp. and <i>Bacillus</i> spp. at recommended rates. <p>Chemical management:</p> <ul style="list-style-type: none"> • Apply etridiazole and metalaxyl; benomyl, mancozeb, maneb, and thiophanate methyl based fungicides at recommended rates against Fusarium wilt pathogens
Justification	Damping off is one of the major seedling diseases affecting Watermelon production. Losses between 40% have been experienced. Integrated management of Damping off is an effective management package against the disease. It involves the integration of various options including cultural, physical, biological and chemical options.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers, Exporters, Farmers, Processors, Extension service providers, Researchers, Academia
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm and on station research trails and demonstrations • Training workshops, seminars, meetings • Field days • Agricultural shows • Farmer research networks • Farmer to farmer • Mass media – Agricultural programs • Promotional materials (posters/brochures/leaflets, manuals) • Web materials • Digital platforms • Farmer Field and Business Schools (FFBS) • Agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Strong partnership linkages • Farmer involvement will be necessary for successful implementation of the IDM package.

	<ul style="list-style-type: none"> • Use of Indigenous Traditional Knowledge (ITK) can be promoted and adopted faster. • Accessibility and cost of the practice by farmers: low-cost agricultural practices are easily promoted and accepted
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 • CGIAR's • NGOs: technology dissemination through on-farm demonstrations; capacity building of farmers • County governments-Help in the dissemination of the technology
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	Marsabit and any other county with suitable agro-ecological settings for Watermelon production.
Challenges in dissemination	<ul style="list-style-type: none"> • Limited knowledge by farmers on integrated disease management • Few farmer group organizations • Lack of Watermelon innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Hold mass campaigns to create awareness on integrated disease management practices and safe use of pesticides
Lessons learned in upscaling, if any	<ul style="list-style-type: none"> • Establish Watermelon innovation platforms • Foster more Partnership in technology dissemination and adoption through innovation platforms. • Adoption of good agricultural practices by the farmers in management of diseases
Social, environmental, policy and market conditions necessary for development and upscaling.	<ul style="list-style-type: none"> • Regulatory bodies e.g. PCPBP, KBS to ensure pesticides being used by farmers are genuine and are of high quality • Farmer's willingness to adopt the disease management practices • Farmers are organized in groups to ensure that management practices are effectively up-scaled • Farm input costs are within the reach of farmers. • 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 • Market able to absorb increased supply of grains
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	(pesticide+labour) Ksh 7,750

Estimated returns	Approximately Ksh 200,000. If IDM of Damping off disease is not applied the yield will be reduced by 50%. Therefore, the estimated returns will be 200,000-100,000= Ksh 100,000
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women and youth have limited knowledge on IDM for Damping off due to lack of access to agricultural information and extension services • Women and youth might not be able purchase the chemical used to for IDM for Damping off because they do not have finances due to limited access to credit facilities • Some of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on IDM for Damping off • IDM for Damping off is cheap and reduces production costs therefore user friendly to poor women • Where IDM for Damping off will involve mulching it will add more work to women who are already burdened by their domestic roles
Gender related opportunities	<ul style="list-style-type: none"> • There will be creation of job opportunities for the youth in setting traps, marketing pest traps and spraying the crop • Adoption of IDM for Damping off will lead to improved productivity of Watermelon hence more income for women • Adoption of IDM for Damping off will also lead to increased food security and nutrition for households • IDM adoption for Damping off will lead to employment opportunities for women and youth at various nodes of Watermelon value chain • There will also a reduction of cost of production for women if IDM for Damping off is adopted.
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 agricultural information and extension so they might not be aware of IDM for Damping off • There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> • The technology can improve food and nutrition security for VMGs • Adoption of IDM for Damping off will lead to improved productivity of Watermelon hence more income for VMGs • IDM adoption for Damping off will lead to employment opportunities for some VMGs such as the youths in spraying

	<ul style="list-style-type: none"> • There will also a reduction of cost of production for VMGs if IDM for Damping off is adopted.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	<p>References:</p> <ul style="list-style-type: none"> • Hall, K. D., Holloway, R. L., & Smith, D. (2000). Texas Crop Profile: Watermelon. <i>Texas FARMER Collection</i>. • Campbell, D.; Tomlinson, J.; Eitzinger, A.; Lizarazo, M.; Buckland, S. (2022) Climate-Smart Agriculture extension services manual for Essex Valley in Jamaica. Kingston (Jamaica): National Irrigation Commission Ltd. Ministry of Agriculture and Fisheries. 55 p. • Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, D. Chattopadhyay, B.S. Sunanda, Ram Asre, K.S. Kapoor, Sanjay Arya, Subhash Kumar, C.S. Patni, Dhanapal, A.N. Sabalpara, S.K. Beura, R.K. Mesta, Biju, B.G. Naik, J. Halder, S. Saha. 2014. AESA based IPM package for Watermelon. pp 40.
F: Status of TIMP Readiness (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
F: Contacts	
Contacts	<p>Centre Director KALRO-Perkerra P.O. Box 32-30403 MARIGAT</p> <p>The Centre Director, KALRO-Kabete; P.O. Box 14733-00800 Nairobi Email: cd.narl@kalro.org Phone: 0727624471</p> <p>The Centre Director Food Crops Research Centre – Muguga South P. O. Box 30148-00100, Nairobi. Email: ferc.muguga@kalro.org Tel: +254-0722219075</p>
Lead organization and scientists	KALRO Jimmy K. Yegon, Ruth Amata., Harun Odhiambo and Mercyline Orayo
Partner organizations	MoALF, ICRAF, CABI

2.9 Postharvest Management

2.9.1 TIMP Name	Harvest management of watermelon
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Postharvest decay caused by inappropriate harvesting methods, which cause bruises in watermelon, which are entry points for rot-causing microorganisms
<p>What is it? (TIMP description)</p>   <p><i>Crimson sweet watermelon ready for harvesting</i></p>  <p>Digital hand refractometer for measuring °Brix</p>  <p>Manual hand refractometer °Brix</p>	<p>This is a management practice involving <i>careful maturity indices</i> (to avoid harvesting premature or deteriorated fruits), <i>main harvesting stages</i> and <i>appropriate harvesting procedure</i>.</p> <p><u>Maturity indices</u></p> <p>Watermelon is ready for harvest when:</p> <ul style="list-style-type: none"> • Tendrils near fruit stem have changed colour from <i>green to brown</i> and dry. Tendrils are small curly appendages attached to the fruit stem slightly above the fruit. • Ground spot on the belly of the melon (where the melon has been resting on the soil) has changed <i>from white to cream or pale yellow</i> • The fruits when thumped with the finger produce <i>muffled dull tone</i> (immature fruits produce <i>clear metallic ringing tone</i>) • The rinds become hard to pierce with finger nails • Mature fruits have <i>sweet flavor, crisp texture</i> and deep red colour • Sugar content (measured as soluble solids by use of hand held refractometer) of 10% or more in the flesh near the centre of the melon • Harvesting generally begins about 30 days after full bloom (2.5-3 months after planting), depending on the variety <p><u>Main harvesting stages:</u></p> <ul style="list-style-type: none"> • Mature but before full ripeness for <i>distant markets</i> • Mature and ripe for <i>nearby markets</i> <p><u>Harvesting method</u></p> <ul style="list-style-type: none"> • Manual harvesting is the most common practice in Kenya. This is done by <i>cutting the vine</i> with a sharp knife, and <i>NOT pulling, twisting or breaking off the vines</i>. This avoids damage to the stem which causes stem end rot. • About 2.5 cm length of stem should be left attached to the fruit when it is cut from the vine to deter against stem end rot.

	<ul style="list-style-type: none"> Watermelons do not ripen after they are picked off the vine, so harvest time is important. If harvested immature, red colour will develop but sugar content does not increase after harvest Shading is necessary in order to protect harvested watermelon from direct sunlight which causes sunburn Due to differences in pollination time, not all watermelons mature at the same time. Thus, the same field may be harvested 2 to 3 times. The main harvest are the 1st and 2nd harvest. Due to their large size and susceptibility to splitting or cracking under mechanical stress, watermelons should not be harvested in the early morning when they are most turgid. Using a damp cloth, manually rub off the soil attached to the ground spot
Justification	Inappropriate timing of harvesting and inappropriate harvesting practices lead to rotting and postharvest losses of watermelon
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, consumers, extension agents
Approaches to be used in dissemination	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 watermelon 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	<p>Farmers – for activity implementation and promotion</p> <p>Extension service (public and private) – technology transfer and dissemination</p> <p>Researchers (KALRO, universities) – establishment of demonstration plots, capacity building of county stakeholders, extension workers and farmers</p> <p>NGOs and CBOs – up-scaling of technologies</p> <p>CIGs play the role of adoption of the technologies through their various groups.</p> <p>VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies.</p>
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir

Counties where TIMPs will be up scaled	West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of knowledge on maturity indices and appropriate harvesting technology • Low uptake before the farmers see the results
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation about the TIMP to farmers • Capacity building of farmers on the TIMP • Further research to improve on establishment of maturity of watermelon fruits
Lessons learned in up scaling, 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 up-scaling	<p>Farmers will be willing to adopt the technology</p> <p>Policies targeting the empowerment of women and youth as entrepreneurs in society</p> <p>The market will be able to absorb the increased supply of watermelon</p>
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased yields due to appropriate harvesting techniques
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 on the management practice. • Women and youth have limited access to education, training and extension services than men.
Gender related opportunities	<ul style="list-style-type: none"> • The management practice increases farm income through reduction of harvest losses. Both men and women can capitalize on this aspect of watermelon 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 on the management practice. • 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"> • Adoption of the TIMP means reduced losses, hence more watermelon available for consumption and sale. This will enable VMGs to have enough watermelon to consume, hence get macro- and micro-nutrients (especially minerals).

	There will be more income for the farmers (VMGs).
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Success stories of high demand of watermelon in other parts of the country due to its high nutritional value
Application guidelines for users	MoA, Kenya. Watermelon Production. SHEP PLUS
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	The Centre Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com , Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, V. Ochieng, Abel Too, James Ndambuki, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI - Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), Seed and chemical companies, Universities, Hotels, restaurants, food processing companies, Exporters, HCDA

RESEARCH GAPS

1. Determination of maturity indices in watermelon under different agro ecological zones.
2. Determination of appropriate harvesting techniques (to minimize incidences of entry of pathogens that would accelerate postharvest deterioration)

2.9.2 TIMP Name	Field assembly and packaging
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Postharvest decay caused by inappropriate harvesting and packaging methods, which cause bruises in watermelon. The bruises are entry points for rot-causing microorganisms.
What is it? (TIMP description)	<ul style="list-style-type: none"> • After harvesting, watermelons are stacked in the field, on the side rather than on their blossom end to reduce the risk of cracking. Placing them in a shaded area will minimize build-up of heat and avoid quality deterioration. The watermelons are packaged in fibreboard boxes or bulk loaded in bins in the field, taking care to load only dried rather than dew-covered fruits. • Watermelon are commonly shipped in bulk, placed on corrugated bins with a capacity of approximately 400 kg,




	<p>or packed into cartons containing 3 to 6 watermelons depending on fruit size, and these cartons should have specially designed inserts to help support the weight of the fruit.</p> <ul style="list-style-type: none"> • Large sized watermelons are usually put in rows in the field prior to being picked up with a transport vehicle. Alternatively, a group of workers can go through the field and toss the melons from one worker to the next, eventually arriving to the person on the transport vehicle. • Fruits of small sized cultivars (i.e. less than 5 kg) can be put in strong wooden field containers and carried out of the field. Usually 3 to 5 fruit are put in a field container. Field sacks should not be used for transporting the fruit out of the field, since they do not provide protection against bruising injury. • Watermelons may be loaded directly from the field into the bed of a truck or trailer and transported to the market. This is essentially a form of field packing. • Watermelons destined for export are taken in bulk from the field to a collection site for grading and packing. Workers should unload the fruit with care and place them on a packing table where other workers sort them into more precise size groups and pack them. Table surfaces should be covered with a non-abrasive material, such as carpet, to help avoid scratching the fruit. • Watermelons packed for export should be put in strong double-walled corrugated cartons containing 3 to 5 watermelons, depending on fruit size and shape. The cartons typically weight between 25 to 35 kg. The carton should be stacked properly to permit adequate airflow through the load during transport.
Justification	Inappropriate handling and packaging methods leads to bruising and cracking, translating to postharvest losses. Internal bruising leads to premature flesh breakdown and mealiness. Good product handling reduces post-harvest crop losses which could be farmers' opportunity to earn more incomes.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, exporters
Approaches to be used in dissemination	On-farm demonstration and training, establishment of collection centres and bulking points, brochures, leaflets and manuals, seminars to create awareness, ICT tools (WhatsApp, mobile apps)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Application of all good agronomic practices in watermelon production (e.g. timely harvesting, correct harvesting, cleaning of the harvested watermelon before packaging)



	<ul style="list-style-type: none"> • Creating awareness on effects of improper post-harvest handling (especially during loading and off-loading operations). • Adequate funding to train on the post-harvest technology
Partners/stakeholders for scaling up and their respective roles	<p>Farmers – for activity implementation and promotion</p> <p>Extension service (public and private) – technology transfer and dissemination</p> <p>Researchers (KALRO, universities) – establishment of demonstration plots, conduct on-farm research, capacity building of county stakeholders, extension workers and farmers</p> <p>NGOs and CBOs (FCI, Twiga Foods) – farmer recruitment and mobilization, up-scaling of technologies</p> <p>Traders – buying watermelons from farmers, dictating on watermelon quality (hence need for appropriate postharvest handling)</p>
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot
Challenges in development and dissemination	Lack of proper handling skills 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 and through FFBS
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Involvement of stakeholders such as CIGS, CBOs and NGOs enhances adoption • Continuous and consistent capacity building is key to attitude change and adoption of the technology.
Social, environmental, policy and market conditions necessary for development and up-scaling	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 income due to reduced postharvest handling losses and enhanced keeping quality
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Field assembly task is mostly performed by women, and this may increase their work burden. • Packing melons in trucks as well as transporting the melons to the market is mostly done mostly by men • Women have less access to information, technology and knowledge on the TIMP. • Women and youth have limited access to education, training and extension services than men.
Gender related opportunities	<ul style="list-style-type: none"> • The TIMP increases farm income through reduction of harvest losses. • Employment opportunity exist for male youths and men in packing, packaging, loading and

	transportation to the market
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 on the management practice • 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 opportunity exist for male youths and men in packing, packaging, loading and transportation to the market Adoption of the management practice means reduced losses, hence more watermelon available for consumption and sale. This will enable VMGs to have enough watermelon to consume, hence get macro- and micro-nutrients (especially minerals). There will be more income for the farmers (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	Brochures, factsheets and manuals
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	The Centre Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com , Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega: F. Wayua, V. Ochieng, Abel Too, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), Universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), Hotels, restaurants, food processing companies, Exporters, HCDA

RESEARCH GAPS

- Determination of appropriate handling techniques (to minimize incidences of entry of pathogens that would accelerate postharvest deterioration)


2.9.3 TIMP Name	Control of postharvest diseases <ul style="list-style-type: none"> • Fungal diseases (black rot, anthracnose, phytophthora fruit rot, Fusarium and stem-end rot) • Bacterial diseases (soft rot)
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem to be addressed	<p>Postharvest decay of harvested watermelon</p>   <p>Anthracnose decay of watermelon fruit (<i>Source: Suslow, UC Davis</i>)</p> <p>ANTHRACNOSE: Dormant infections may exist at harvest, with no external evidence of the disease. During storage, the latent infections may become active at high temperatures or after exposure to chilling injury inducing conditions. CONTROL – removal of infected debris, storage at 10°C will retard the growth of this fungus.</p>  <p>Fusarium rot on 'Sugar Baby' watermelon</p>

	 <p>Greasy spot and associated whitish mold growth of Phytophthora infected fruit</p>  <p>Stem-end rot.</p> <p>BACTERIAL SOFT ROT Insect damage, fungal decay and mechanical injury predispose the fruits to infection. The disease causes rapid fruit rot and rancidity. Foul odours develop within a few days at ambient temperatures. The disease can be avoided by careful handling of the fruit to minimize rind damage.</p>
What is it? (TIMP description)	<p>A combination of management practices for controlling fungal and bacterial rots in watermelons:</p> <ul style="list-style-type: none"> • At least 2.5 cm of stem should remain attached to the fruit at harvest • Careful handling of the fruit to minimize rind damage • Sorting out infected fruits • Store harvested fruits at 10°C
Justification	<p>Fungal and bacterial rots are important sources of postharvest loss of watermelons. The amount of disease pressure depends on cultural practices during production and the local climatic conditions at harvest. Disease pressure is greater in areas with high rainfall and humidity during production and harvest.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, exporters and consumers (households, institutions, restaurants, hotels and food processing industry)
Approaches to be used in dissemination	On farm demonstration and training, brochures on post-harvest handling of watermelons, seminars to create awareness, farmer exchange visits and study tours, ICT (WhatsApp and mobile apps)
Critical/essential factors for successful promotion	Application of good agronomic practices in watermelon production (e.g. timely harvesting, correct harvesting, keeping harvested watermelon under shade)
Partners/stakeholders for scaling up and their respective roles	Farmers – for activity implementation and promotion Extension service (public and private) – technology transfer and dissemination, policy formulation and enforcement

	<p>Researchers (KALRO, universities) – establishment of demonstration plots, conduct on-farm research, capacity building of county stakeholders, extension workers and farmers</p> <p>NGOs and CBOs (FCI, Twiga Foods) – farmer recruitment and mobilization, up-scaling of technologies</p> <p>Exporters and packhouse operators – buying watermelons from farmers;</p> <p>Consumers – buying watermelons from farmers and traders, hence need for appropriate handling and storage</p>
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot
Challenges in development and dissemination	Lack of knowledge and awareness on control of bacterial and fungal rots of watermelon
Suggestions for addressing the challenges	Creating awareness and capacity building on control of postharvest diseases of watermelon
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Proper postharvest handling reduce loss up to 25% • Involvement of stakeholders such as CIGs, CBOs and NGOs enhances adoption • Continuous capacity building is key to attitude change. • Consistent trainings, demonstrations and sensitisations would motivate farmers to adopt the technology
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • The technology is environment friendly as it will reduce postharvest losses caused by bacterial and fungal rots • There is high demand for watermelon of superior grade
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Reduced postharvest losses, hence increased sales, income and enhanced family nutrition
Gender issues and concerns in development and dissemination	The technology can be adopted by all gender, it's easily applicable hence farmers can easily learn it.
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 chemicals than men • Women 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 exist to use the affected melons as livestock feed by both men and women

	<ul style="list-style-type: none"> • Employment opportunities exist for women to plough/incorporate in - the affected melons into the soil as green manure
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 chemicals than men • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to information on production techniques • There is low adoption by VMGs due lack of awareness
VMG related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women to plough/incorporate in - the affected melons into the soil as green manure
E: Case studies/profiles of success stories	
Success stories	None
Application guidelines for users	<ul style="list-style-type: none"> • Brochures, factsheets and manuals • Bulletins, policy briefs
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	The Institute Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com , Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, Abel Too, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), hotels, restaurants, food processing companies, exporters, HCDA

2.9.4 TIMP Name	Sorting and grading of watermelon
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	

<p>Problem to be addressed</p>	<ul style="list-style-type: none"> • Poor quality due to mix-up of watermelon of different grades postharvest (mixing of good quality watermelon with damaged ones) • Spread of rot-causing microorganisms from good quality to poor quality watermelon
<p>What is it? (TIMP description)</p>  <p><i>Fruits ready for the market after sorting and grading</i></p>	<p>Sorting:</p> <ul style="list-style-type: none"> • Watermelons are sorted to remove insect damaged, blossom-end rot, cracked, discolored, without stalk attached • Inferior melons are sorted and packed in large, sturdy, tri-wall fibreboard containers. <p>Grading:</p> <ul style="list-style-type: none"> • Watermelon are graded based on their external appearances which include size (small, medium and large) for each variety. Good quality watermelon should be uniform in appearance and having a waxy bright surface devoid of scars, abrasions, sunburns, decays and other surface defects. Defecting fruits as a result of stacking or fruits dropping on the floor mistakenly can be sold at a cheaper price in nearby markets. • Preliminary grading of market quality fruit should be done in the field at the time of harvest. Deformed, insect damaged, partially decayed, or cracked fruit should not be loaded or transported to the market. • Watermelons destined for export must meet the quality standards established by the receiver. Typically, the fruits are more carefully inspected than those intended for the domestic market. The presence of diseases, insects, or soil can result in failure to meet phytosanitary requirements at the destination and lead to rejection of the entire shipment. • In addition to the external appearance, randomly selected fruit should be cut open and checked for internal quality. The edible flesh should have a sugar content (minimum of 10% soluble solids), a deep red colour, and a pleasant crisp texture. These quality characteristics are dependent on fruit maturity, cultivar and postharvest care.
<p>Justification</p>	<p>Sorting removes insect damaged, blossom-end rot, cracked, discolored, without stalk attached, hence reducing the spread of rot-causing microorganisms, hence extends the shelf-life. Graded watermelon fetches better prices to the farmer and trader</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Farmers, traders and buyers (households, institutions, hotels, restaurants, food processing companies, hotels)</p>
<p>Approaches to be used in dissemination</p>	<p>On farm demonstration and capacity building of farmers and value chain actors, brochures on post-harvest handling of watermelons, seminars to create awareness</p>
<p>Critical/essential factors for successful promotion</p>	<p>Favourable policy whereby premium grade is paid higher price</p>
<p>Partners/stakeholders for scaling up and their respective roles</p>	<p>Farmers – for activity implementation and promotion</p>

	<p>Extension service (public and private) – technology transfer and dissemination, policy formulation and enforcement</p> <p>Researchers (KALRO, universities) – establishment of demonstration plots, conduct on-farm research, capacity building of county stakeholders, extension workers and farmers</p> <p>NGOs and CBOs (FCI, Twiga Foods) – farmer recruitment and mobilization, up-scaling of technologies</p> <p>Exporters and packhouse operators – buying watermelons from farmers;</p> <p>Consumers – buying watermelons from farmers and traders, hence need for appropriate handling and storage</p>
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot
Challenges in development and 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 watermelon quality requirement
Lessons learned in up scaling, if any	Proper postharvest handling reduce loss by up to 25%
Social, environmental, policy and market conditions necessary for development and up-scaling	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	Reduced losses, better quality, and increased income and 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	<ul style="list-style-type: none"> • Employment opportunity exist for and women in sorting and grading
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 land. • 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 exist for some VMGs especially women sorting and grading.
E: Case studies/profiles of success stories	
Success stories	Farmers in Baringo have adopted the technology
Application guidelines for users	<ul style="list-style-type: none"> • Brochures, factsheets and manuals

	<ul style="list-style-type: none"> • Bulletins, policy briefs
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	The Institute Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com , Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, Abel Too, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), hotels, restaurants, food processing companies, exporters, HCDA


2.9.5. TIMP Name	Storage of watermelons
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Postharvest decay caused by inappropriate storage
What is it? (TIMP description)	The TIMP involves storing watermelon at cool temperatures to extend shelf life. If cut open, wrap it tightly in plastic and store in the refrigerator. An open watermelon can last for about 4 days in this condition. If you are going to transport the watermelon fruits to a distant market, store the watermelons in a refrigerating van at 7.2°C with 85-90% relative humidity. However, holding watermelons at this temperature for too long will induce chilling injury to the fruit. If you transport the watermelons to the market without pre-cooling, or refrigerating during transit, then the fruits must be consumed immediately as quality declines rapidly under these conditions. Avoid storing watermelons with apples, passion fruits and avocados as they produce ethylene while in storage that softens and changes the flavor of the watermelon
Justification	Watermelon is a perishable commodity and often deteriorates losing quality under poor handling and storage conditions. Proper handling and storage is crucial to assure farmers of reduced losses during storage handling phases.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, exporters
Approaches to be used in dissemination	On farm demonstration and training, establishment of collection centres and bulking points, brochures, leaflets and manuals, seminars to create awareness, ICT tools (WhatsApp, mobile apps)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Application of all good agronomic practices in watermelon production (e.g. timely harvesting, correct harvesting) • Creating awareness on effects of improper post-harvest handling • Adequate funding to train on the post-harvest technology • Availability of funds to support farmer groups to build strategic storage facilities
Partners/stakeholders for scaling up and their respective roles	<p>Farmers – for activity implementation and promotion</p> <p>Extension service (public and private) – technology transfer and dissemination</p> <p>Researchers (KALRO, universities) – establishment of demonstration plots, conduct on-farm research, capacity building of county stakeholders, extension workers and farmers</p> <p>NGOs and CBOs (FCI, Twiga Foods) – farmer recruitment and mobilization, up-scaling of technologies</p> <p>CIGs play the role of adoption of the technologies through their various groups.</p> <p>VMGs will likewise benefit from the grants as they adopt the technologies. They are the recipients of the technologies.</p> <p>HCD will capacity build farmers in cool storage technologies of farmers produce.</p>


	Traders – buying watermelons from farmers, dictating on watermelon quality Financial institutes – avail funds to establish cold storage facilities
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> • Lack of knowledge and awareness on good storage facilities by smallholder farmers • Lack of funds to establish cold storage facilities
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building on watermelon storage technology • Availing appropriate financing to value chain actors for establishment of storage facilities
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> • Involvement of stakeholders such as CBOs and NGOs enhances adoption • Continuous and consistent capacity building is key to attitude change and adoption of the technology.
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Policies targeting the empowerment of women and youth as entrepreneurs in society. • There is high demand for good quality watermelons hence better market prices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Increased income due to reduced storage losses and enhanced keeping quality
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 • Women may have less access to credit to purchase storage facilities such as refrigerators
Gender related opportunities	<ul style="list-style-type: none"> • -
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 land. • 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"> • -
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	Brochures, factsheets and manuals

F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	The Institute Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com, Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, Abel Too, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), hotels, restaurants, food processing companies, exporters, HCDA

RESEARCH GAPS


1. Identify suitable storage and handling techniques at farm-gate and market stages for watermelon.
2. Determine appropriate packaging for ease of transportation to distant markets
3. Establishment of linkages for large-scale cold storage facilities


2.9.6 TIMP Name	Zero Energy Brick Cooler
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 (30%) caused by lack of cooling technologies for watermelon
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.
	
<i>Zero Energy Brick Cooler</i>	

	 <p><i>Zero Energy Brick Cooler</i></p>
Justification	Appropriate cooling reduces postharvest losses and extends shelf-life, hence the watermelon can be marketed and consumed over a long period and distances. The technology can be used by off-the grid farmers since it does not require any form of power.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers , traders, green grocers, processors, household consumers, extension workers
Approaches to be used in dissemination	Training workshops, demonstrations, extension materials
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Use of locally available materials to construct the coolers • Funding to promote the coolers • Formation of marketing groups that would construct the coolers communally • County and Central Government support • Well organized farmer groups and networks
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers groups to be trained in postharvest handling of the cabbage • Scientists and agricultural extension workers- to provide farmers with knowledge on ZECC • Market players to create a demand and, therefore, increase area production • County governments, central governments for development of enabling policies and create awareness. • Financial institutions to provide credit facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	Embu, Kirinyaga
Counties where TIMP will be up scaled	West Pokot
Challenges in dissemination	Lack of knowledge on Zero Energy Brick Cooler Lack of starter capital to construct the cooler

Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Awareness creation and capacity building about the technology to farmers and traders • Avail appropriate financing
Lessons learned in up scaling 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 up scaling	<ul style="list-style-type: none"> • The sand should be continuously moist. Cooling is more effective in dry and windy environment • Ability of farmers to practice collective marketing of cabbage • Proper linkages between industry, farmer cooperatives, local and regional markets, and bulk purchases • Existing and new export markets are developed and maintained • Policies to encourage cold chain in horticulture sector are implemented. • Favourable policy, encouraging better prices for properly-preserved cabbage
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Low cost, approximately KES 100,000/-
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 on the zero energy brick cooler technology • Women and youth have limited access to education, training and extension services than men • Women and youth have less access to credit to purchase the technology than men
Gender related opportunities	<ul style="list-style-type: none"> • Affirmative action opportunities such as the women and youth enterprise fund and youth funds exist for women and youths to access the required finances
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 on the the zero energy brick cooler technology • Women and youth have less access to credit to purchase the technology than men • VMGs have limited access to training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by VMGs due lack of awareness.

VMG related opportunities	<ul style="list-style-type: none"> Affirmative action opportunities such as the women and youth enterprise fund and youth funds exist for women and youths to access the required finances
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Fruit and vegetable farmers in Kirinyaga, Embu, etc. have used the technology to reduce losses and extend shelf-life, hence the marketing time for the vegetables.
Application guideline for users	Wayua, F. Ndambuki, J., Ochieng, V. and Wasilwa, L. (2021). Zero Energy Cool Chamber. KALRO/KCSAP Programme Factsheet. September 2021
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires validation
G: Contacts	
Contacts	The Institute Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com, Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, Abel Too, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), hotels, restaurants, food processing companies, exporters, HCDA

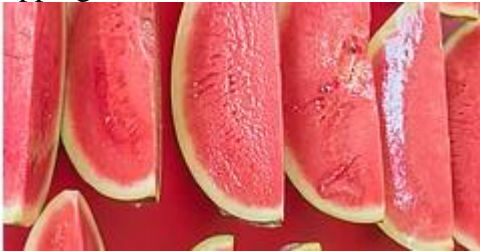
2.8.7 TIMP Name	Evaporative Charcoal Cooler
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	High postharvest losses (30%) caused by lack of cooling technologies for watermelon
What is it? (TIMP description)	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.
	

<i>Evaporative charcoal cooler for fruits and vegetables</i>	 <p><i>Evaporative charcoal cooler for fruits and vegetables</i></p>
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 to be used in dissemination	Training workshops, demonstrations, extension materials, exposure tours
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Existence of effective extension services to demonstrate the technology • Accessibility and cost of the cooler to farmers and traders • Funding to promote the cooler-powered ware potato stores • The cooler can be installed at aggregation centres (collection points)
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers groups to be trained in postharvest handling of the watermelon • 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 TIMP will be up scaled	West Pokot
Challenges in dissemination	Lack of starter capital to construct the cooler
Suggestions for addressing the challenges	Avail appropriate financing
Lessons learned in up scaling 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 up scaling	<ul style="list-style-type: none"> • The charcoal should be continuously moist. Cooling is more effective in dry and windy environment; • Ability of farmers to practice collective marketing of watermelon • Proper linkages between industry, farmer cooperatives, local and regional markets, and

	<p>bulk purchases</p> <ul style="list-style-type: none"> Existing and new export markets are developed and maintained Policies to encourage cold chain in horticulture sector are implemented. Favourable policy, encouraging better prices for properly-preserved watermelon
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Approximately 80,000/-
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 on the Evaporative charcoal cooler technology Women and youth have limited access to education, training and extension services than men Women and youth have less access to credit to purchase the technology than men
Gender related opportunities	<ul style="list-style-type: none"> Affirmative action opportunities such as the women and youth enterprise fund and youth funds exist for women and youths to access the required finances
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 on the Coolbot™ cold storage technology Women and youth have less access to credit to purchase the technology than men VMGs have limited access to training and extension services. Due to their social status VMGs are often excluded from decision making in development and dissemination activities. There is low adoption by VMGs due lack of awareness.
VMG related opportunities	<ul style="list-style-type: none"> Affirmative action opportunities such as the women and youth enterprise fund and youth funds exist for women and youths to access the required finances
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 guideline for users	Wayua, F. Ndambuki, J., Ochieng, V. and Wasilwa, L. (2021). CoolBot ^T . KALRO/KCSAP Programme Factsheet. September 2021

F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Requires validation
G: Contacts	
Contacts	The Institute Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com, Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, Abel Too, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), hotels, restaurants, food processing companies, exporters, HCDA


2.10 Value Addition Of Watermelon

2.10.1 TIMP Name	Watermelon slices
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Wastage of products from direct consumption of fruits
What is it? (TIMP description)	Watermelon slices packed in punnets and cling film wrappings  <p>Watermelon slices (F. Wayua, KALRO)</p>
Justification	Watermelon is mostly utilized fresh as a dessert, garnish and pudding (frozen or fresh salads) and fresh juice (pure or mixed). This is often done without proper packaging and when it is served many times it is in a form that may not be transport- friendly due to the juice which may pour on the consumer. There is need to establish innovative ways in which the fresh fruit can be cut into portable packages that can be available in outlets at affordable costs as opposed to buying a whole fruit.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches to be used in dissemination	On farm demonstration and training, brochures on post-harvest handling of watermelons, seminars to create

	awareness, farmer exchange visits and study tours, Capacity building – Common Interest Groups (CIG)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> Facilitate long shelf life for the product both in shelf at home and in the market; Cost of packaging material (punnets and cling-film wrappings) can be costly for the women in small-scale business.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> MoA 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 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	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot
Challenges in development and dissemination	The packaging materials will increase cost of the product
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Carrying out adaptive trials to package value added technologies of watermelon Involving other stakeholders in the manufacturing industry to provide affordable solutions for the packaging material.
Lessons learned in up scaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and up-scaling	Target women and youth as entrepreneurs in society who are the major adopters (traders of watermelon) and consumers, respectively.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Costs of packaging material
Estimated returns	Increased income and nutrition through production and sale of packed watermelon slices
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Women may have less access to information, technology and knowledge on the technology. Women may have limited access to education, training and extension services on the technology.
Gender related opportunities	<ul style="list-style-type: none"> Employment opportunities exist for women in making cutting the melons in slices for both home consumption for sale.


VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs may have less access to agricultural information, technology and knowledge on the technology. • VMGs have limited access to training and extension services on the technology. • 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 some VMGs such as women in cutting the melons in slices for both home consumption and for sale.
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	Watermelon slices production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	The Institute Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com, Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, Abel Too, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), hotels, restaurants, food processing companies, exporters, HCDA

2.10.2 TIMP Name	Watermelon juice
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited watermelon utilisation food products; high postharvest losses due to high perishability, and low market prices

What is it? (TIMP description)	Juice extracted from ripe watermelon, pasteurized and packaged 
Justification	Diversification of watermelon products will enhance consumption of watermelon, enhance demand and thus spur increased production. Over-ripe watermelon should not be thrown away. The watermelon which have a sweet taste, fine flavour and texture 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 to be used in dissemination	On-farm demonstration and training, brochures on post-harvest handling of watermelons, seminars to create awareness, farmer exchange visits and study tours, Capacity building – Common Interest Groups (CIG)
Critical/essential factors for successful promotion	Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high quality watermelons, availability of quality standards; Farmers should organise themselves into growers' associations which facilitate setting up of factories to process watermelons into various products; The government should facilitate affordable credit to empower farmers take up watermelon agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • MoA 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 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	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot


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 watermelon 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 up-scaling process, linkage to credit facility providers to promote commercialisation, advocacy for standards development for value added watermelon products; nutrition education to consumers
Lessons learned in up scaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and up-scaling	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 watermelon agribusiness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KSh 50/- per 250 ml
Estimated returns	Increased income and nutrition through production, sale and consumption of watermelon juice
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to information, technology and knowledge on the technology. • Women may have limited access to education, training and extension services on the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in making the melon juice for both home consumption for sale.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs may have less access to agricultural information, technology and knowledge on the technology. • VMGs have limited access to training and extension services on the technology. • 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 some VMGs such as women in making melon juice product for both home consumption and for sale.
E: Case studies/profiles of success stories	
Success stories	High demand of watermelon juice
Application guidelines for users	Ndambuki, J., Wayua, F., Yegon, J. and Wasilwa, L. (2021). Watermelon juice. KALRO / Value Addition Programme Factsheet No. #

F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	The Institute Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com, Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, Abel Too, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), hotels, restaurants, food processing companies, exporters, HCDA

2.10.3 TIMP Name	Watermelon wine
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited watermelon utilisation food products
What is it? (TIMP description)	Wine prepared from ripe watermelon. It is made by fermenting watermelon juice by adding wine yeast and sugar.
	
Justification	Diversification of watermelon food products will enhance consumption of watermelon, 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 to be 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	Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private

	Partnerships (PPP); availability of high quality watermelons, availability of quality standards; Farmers should organise themselves into growers' associations which facilitate setting up of factories to process watermelons into various products; The government should facilitate affordable credit to empower farmers take up watermelon agribusiness.
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • MoA 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. • Processors – processing watermelon wine • 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 watermelon juice
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot
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 watermelon 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 up-scaling process, linkage to credit facility providers to promote commercialisation, advocacy for standards development for value added watermelon products; nutrition education to consumers
Lessons learned in up scaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and up-scaling	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 watermelon agribusiness.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet estimated

Estimated returns	Increased income through production and sale of watermelon wine
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to information, technology and knowledge on the technology. Women may have limited access to education, training and extension services on the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in making the melon wine for both home consumption for sale.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs may have less access to agricultural information, technology and knowledge on the technology. • VMGs have limited access to training and extension services on the technology. • 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 some VMGs such as women in making the melon wine for both home consumption and for sale.
E: Case studies/profiles of success stories	
Success stories	The case of Nyangorora Watermelon Processors in Kisii County. This group processes watermelon juice and sell to the community
Application guidelines for users	Ndambuki, J., Wayua, F., Yegon, J. and Wasilwa, L. (2021). Watermelon wine. KALRO / Value Addition Programme Factsheet No. #. September 2021.
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	The Institute Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com, Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, Abel Too, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), hotels, restaurants, food processing companies, exporters, HCDA

2.10.4 TIMP Name	Watermelon jam
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited watermelon utilisation food products
What is it? (TIMP description)	Jam prepared from ripe watermelon 
Justification	Diversification of watermelon food products will enhance consumption of watermelon, enhance demand and thus spur increased production. Over-ripe watermelon should not be thrown away. The watermelon which have a sweet taste, fine flavour and texture 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 to be used in dissemination	On farm demonstration and training, brochures on post-harvest handling of watermelons, seminars to create awareness, farmer exchange visits and study tours, capacity building – Common Interest Groups (CIG)
Critical/essential factors for successful promotion	Participatory implementation, stakeholder capacity building and networks, promotions involving Public Private Partnerships (PPP); availability of high quality watermelons, 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 • MoA 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. • Processors – processing watermelon 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 watermelon juice
C: Current situation and future scaling up	

Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot
Challenges in development and dissemination	Limited awareness of product by farmers and consumers; limited processing technology at the household level. Watermelon mainly eaten ripe; Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities, limited consumer awareness of value added watermelon 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 up-scaling process, linkage to credit facility providers to promote commercialisation, advocacy for standards development for value added watermelon products; nutrition education to consumers
Lessons learned in up scaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and up-scaling	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	KSh 300/- per 200 ml
Estimated returns	Increased income through production and sale of watermelon jam
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to information, technology and knowledge on the technology. • Women may have limited access to education, training and extension services on the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in making the jam for both home consumption for sale.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs may have less access to agricultural information, technology and knowledge on the technology. • VMGs have limited access to training and extension services on the technology. • 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 some VMGs such as women in making the jam for both home consumption and for sale.
E: Case studies/profiles of success stories	
Success stories	Farmers and traders in Baringo have adopted the technology

Application guidelines for users	Ndambuki, J., Wayua, F., Yegon, J. and Wasilwa, L. (2021). Watermelon wine. KALRO / Value Addition Programme Factsheet No. #. September 2021.
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	The Institute Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com, Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, Abel Too, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	Ministry of Agriculture (County Governments), universities, CBO and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.), hotels, restaurants, food processing companies, exporters, HCDA

2.10.5 TIMP Name	Watermelon powder
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited watermelon utilisation food products
What is it? (TIMP description)	Powder prepared from drying watermelon juice
Justification	Diversification of watermelon products will enhance consumption of watermelon, enhance demand and thus spur increased production. Watermelon powder can be processed by drying watermelon juice. The powder can be used as a food additive or it can be reconstituted
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of watermelons • 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 watermelons, 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 • MoA 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. • Processors – processing watermelon powder • 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 watermelon juice
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot
Challenges in development and dissemination	Limited awareness of product by farmers and consumers; limited processing technology at the household level. Cooking watermelons mainly boiled; Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities, limited consumer awareness of value added watermelon 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 up-scaling process, linkage to credit facility providers to promote commercialisation, advocacy for standards development for value added watermelon products; nutrition education to consumers
Lessons learned in up scaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and up-scaling	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 watermelon powder
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to information, technology and knowledge on the technology. • Women may have limited access to education, training and extension services on the technology.

Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in making the melon powder for both home consumption for sale.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs may have less access to agricultural information, technology and knowledge on the technology. • VMGs have limited access to training and extension services on the technology. • 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 some VMGs such as women in making the jam for both home consumption and for sale.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to information, technology and knowledge on the technology. • Women may have limited access to education, training and extension services on the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in making the melon powder for both home consumption for sale.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Watermelon seed flour production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	The Centre Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com , Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture (County Governments) • JKUAT • Egerton University • CBOs and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.) • Hotels, restaurants, food processing companies • Exporters • HCDA

2.10.6 TIMP Name		Watermelon seed flour
Category (i.e. technology, innovation or management practice)	Technology	
A: Description of the technology, innovation or management practice		
Problem to be addressed	Limited watermelon utilisation food products	
What is it? (TIMP description)	Flour prepared by grinding dried watermelon seeds	
Justification	<p>Diversification of watermelon products will enhance consumption of watermelon, enhance demand and thus spur increased production.</p> <p>Watermelon seeds can be processed to make flour, which can either be fortified or used to make nutritious porridge, and mixed with wheat flour (ration of 1:1), it can be used to make <i>chapati</i>, <i>mandazi</i> and cakes.</p>	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, consumers	
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of watermelon • 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 watermelons, 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 • MoA 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. • Processors – processing watermelon powder • 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 watermelon juice 	
C: Current situation and future scaling up		
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir	
Counties where TIMPs will be upscaled	West Pokot	

Challenges in development and dissemination	Limited awareness of product by farmers and consumers; limited processing technology at the household level. Watermelon seeds are most often discarded; Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities, limited consumer awareness of value added watermelon 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 up-scaling process, linkage to credit facility providers to promote commercialisation, advocacy for standards development for value added watermelon products; nutrition education to consumers
Lessons learned in up scaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and up-scaling	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 watermelon seed flour and flour-based products
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to information, technology and knowledge on the technology. • Women may have limited access to education, training and extension services on the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in making the melon seed flour for both home consumption for sale.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs may have less access to agricultural information, technology and knowledge on the technology. • VMGs have limited access to training and extension services on the technology. • 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 some VMGs such as women in making the jam for both home consumption and for sale.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to information, technology and knowledge on the technology. • Women may have limited access to education, training and extension services on the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in making the melon seed flour for both home consumption for

	sale.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Watermelon seed flour production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	The Centre Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com , Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture (County Governments) • JKUAT • Egerton University • CBOs and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.) • Hotels, restaurants, food processing companies • Exporters • HCDA

2.10.7 TIMP Name	Watermelon seed oil
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Limited watermelon utilisation food products
What is it? (TIMP description)	Edible oil extracted from dry watermelon seeds
Justification	Diversification of watermelon products will enhance consumption of watermelon, enhance demand and thus spur increased production. Edible oil can be extracted from watermelon seeds which can be used for human consumption.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension agencies, small-scale processors, entrepreneurs, traders, restaurants, orphanages and children's homes, consumers
Approaches to be used in dissemination	<ul style="list-style-type: none"> • On farm demonstration and training • Brochures on post-harvest handling of watermelons • 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 watermelons, availability of quality standards and processing equipment (edible oil extraction machines)
Partners/stakeholders for scaling up and their respective roles	<ul style="list-style-type: none"> • Farmers – for activity implementation and promotion • MoA 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. • Processors – processing watermelon seed oil • 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 watermelon juice
C: Current situation and future scaling up	
Counties where already promoted, if any	Baringo, Elgeyo- Marakwet, Laikipia, Samburu and Wajir
Counties where TIMPs will be upscaled	West Pokot
Challenges in development and dissemination	Limited awareness of product by farmers and consumers; limited processing technology at the household level. Watermelon seed quite often discarded; Difficulty in acquiring certificates from regulatory authorities, lack of standards for the product, lack of credit facilities, limited consumer awareness of value added watermelon 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 up-scaling process, linkage to credit facility providers to promote commercialisation, advocacy for standards development for value added watermelon products; nutrition education to consumers
Lessons learned in up scaling, if any	A good value added product will penetrate the market very fast.
Social, environmental, policy and market conditions necessary for development and up-scaling	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 watermelon seed oil


Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to information, technology and knowledge on the technology. • Women may have limited access to education, training and extension services on the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in making the melon seed oil for both home consumption for sale.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs may have less access to agricultural information, technology and knowledge on the technology. • VMGs have limited access to training and extension services on the technology. • 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 some VMGs such as women in making the jam for both home consumption and for sale.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women may have less access to information, technology and knowledge on the technology. • Women may have limited access to education, training and extension services on the technology.
Gender related opportunities	<ul style="list-style-type: none"> • Employment opportunities exist for women in making the melon seed oil for both home consumption for sale.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Watermelon seed oil production leaflets and manuals
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Require validation
G: Contacts	
Contacts	The Centre Director, KALRO-Kakamega; P. O. Box 169-50100, Kakamega. Email: francis.wayua@gmail.com , Tel. 0710629683
Lead organization and scientists	KALRO-Kakamega F. Wayua, V. Ochieng, Wasilwa L KALRO-Perkerra - Jimmy K. Yegon, KALRO-GeRRI -Timon Moi, KALRO HQ -Dr Lusike Wasilwa, KALRO Muguga South-David K. Lelgut,
Partner organizations	<ul style="list-style-type: none"> • Ministry of Agriculture (County Governments) • JKUAT • Egerton University

	<ul style="list-style-type: none"> • CBOs and NGOs (e.g. Farm Concern International (FCI), Twiga Foods Ltd.) • Hotels, restaurants, food processing companies • Exporters • HCDA
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RESEARCH GAPS:


Characterisation of the watermelon seed oil

2.11 Mechanization of Watermelon Production Activities

2.11.1 TIMP Name	Power tiller
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 watermelons commodity • Difficult to prepare a uniform fine tilth seedbed manually • Delayed operation lead to late planting • High cost of manual labour
What is it? (TIMP description)  <p>(Source; Nasirembe, ATDC Siakago 2021)</p>	A Power tiller is a low powered two-wheeled agricultural implement, also referred to as a walking tractor 8-16hp that can be fitted with a rotary tiller, disk harrow, mouldboard plough, trailer, water pump or chisel at alternate times for easing farm operations. It can complete one hectare per day by one operator in about two hours though the machine could do more with a different operator. This will vary depending on the climatic conditions, soil types, soil moisture content, operator stamina and experience. Fuel consumption is about 15 litres per ha. Though these results may vary with the technical ability of the operator.
Justification	It has multiple uses and other advantages. A Power Tiller can be used in seedbed preparation, sowing seed, planting seed, spraying fertilizer, herbicide and even irrigation. In addition, can also be used for transporting produce. A power tiller is ideal where the land size is small. Farm sizes less than one hectare may limit manoeuvrability of conventional tractors while manual labour is slow and costly.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Watermelon farmers and researchers
Approaches to be used in dissemination	Field Demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	KALRO, Universities (for information) Machinery fabricators NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be up scaled	Nakuru, Bungoma, Trans Nzoia, Busia, Baringo
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of the machines • High initial cost for small-scale farmer when fabricated.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Acquisition of the machines • Facilitation for demonstration • Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations • Increase Labour productivity • Increase land productivity • Decrease cost of production • Enhance quality of produce • Reduce drudgery • Strengthens entrepreneurship • Enhances Industrialization through cottage industry sprouting • Triggers Manufacturing and agro-processing
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 280,000
Estimated returns	Four Ha. per day
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Gender unfriendly and expensive machines • Watermelon machines should be designed for easy start and operation. • Up-scaling should target all the gender • Affordability to all gender
Gender related opportunities	<ul style="list-style-type: none"> • Creates employment especially for youth


	<ul style="list-style-type: none"> • Reduces drudgery for women farmers as well as men
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Facilitation to access information • Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO, Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators

2.11.2 TIMP Name	4-Wheeled Tractor 50Hp
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"> • Slow and tedious processes of seedbed preparation, in a commercialized watermelon commodity • Difficult to prepare a uniform fine tilth seedbed manually • Delayed operation lead to late planting • High cost of manual labour
What is it? (TIMP description)	<p>A small sized, a 4 wheeled tractor is a low powered agricultural implement of 40-55hp that can be fitted with a rotary tiller, disk harrow, mouldboard plough, trailer, water pump or chisel at alternate times for easing farm operations. It can complete 4 hectares per day by one operator but can have two operators to run another 8 hours of 4 hectares coming to 8 per day. This will vary depending on the climatic conditions, soil types, soil moisture content and operator experience. Fuel consumption is about 15 litres per ha. Though these results may vary with the technical ability of the operator.</p>
	

(Source; Nasirembe, ATDC Siakago 2021)	
Justification	It has multiple uses and other advantages. A 4 wheeled tractor can be used in seedbed preparation soil, sowing seed, planting seed, spraying fertilizer, herbicide and even irrigation. In addition, can also be used for threshing through a power take off device and transporting produce. Farm sizes less than two hectares may be appropriate for use having advantage of speed, precision, consistence and uniformity and low cost of work over manual labour
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Watermelon farmers and researchers
Approaches to be used in dissemination	Field demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	KALRO, Universities (for information) Machinery dealers NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be up scaled	Nakuru, Bungoma, Trans Nzoia, Busia, Baringo
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of facilitation for demonstration • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Acquisition of the tractors • Lack of facilitation for demonstration • Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations • Increase Labour productivity • Increase land productivity • Decrease cost of production • Enhance quality of produce • Reduce drudgery • Strengthens entrepreneurship • Enhances Industrialization through cottage industry sprouting
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization


D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 1,780,000,00
Estimated returns	3ha. Per day
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Gender Unfriendly and expensive machines • Watermelon machines should be designed for easy start and operation. • Up-scaling should target all the gender • Affordability to all gender
Gender related opportunities	<ul style="list-style-type: none"> • Creates employment especially for youth • Reduces drudgery for women farmers as well as men
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Facilitation to access information • Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators

2.11.3 TIMP Name	Mouldboard 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 Watermelon commodity • Difficult to prepare a uniform fine tilth seedbed manually • Delayed operation lead to late planting • High cost of manual labour

<p>What is it? (TIMP description)</p>  <p>(Source; https://www.google.com/url?sa=i&url=https%3A%2F%2Fn ewandusedtractors.com%2Fproduct%2Fmould-board-ploughmould-board-plough-for-sale%2F&psig=AOvVaw2VjunfG8n0BKdaMIGEF9RX&ust=1666167134976000&source=images&cd=vfe&ved=0CA0QjRxqFwoTCPjMkLSq6foCFQAAAAAdAAAAABAE)</p>	<p>Mouldboard plough is an agricultural implement and is generally considered to be the important tillage implement. Mouldboard ploughs are available for power tiller and tractor operation. A mouldboard plough does four jobs namely a) cutting the furrow slice, b) lifting the furrow slice, c) inverting the furrow slice and d) pulverizing the furrow slice. Ploughing accounts for more traction energy than any other field operation.</p>
<p>Justification</p>	<p>High Efficiency. When well-adjusted, the plough automatically seeks the desired depth. It is Versatility. The various models have different features that enable high efficiency in preparation of the land. Weed Control. Pest Control. Improved Soil Health.</p>
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Watermelon farmers, Universities and researchers</p>
<p>Approaches to be used in dissemination</p>	<p>Field Demonstrations, exhibitions, agricultural shows (ASK) and training</p>
<p>Critical/essential factors for successful promotion</p>	<p>Multiple usage, efficiency and low cost</p>
<p>Partners/stakeholders for scaling up and their roles</p>	<p>KALRO, Universities (for information) Machinery fabricators NGO supporting farmers for dissemination</p>
<p>C: Current situation and future scaling up</p>	
<p>Counties where already promoted</p>	<p>Baringo,</p>
<p>Counties where TIMP will be up scaled</p>	<p>Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Wajir, Siaya</p>
<p>Challenges in dissemination</p>	<ul style="list-style-type: none"> • Lack of facilitation for demonstration • High initial cost for small-scale machines
<p>Suggestions for addressing the challenges</p>	<ul style="list-style-type: none"> • Acquisition of the machines • Lack of facilitation for demonstration • Build capacity through efficient agricultural production to afford the cost
<p>Lessons learned in up scaling if any</p>	<ul style="list-style-type: none"> • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas • Provides low cost farm operations

Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 550,000
Estimated returns	4ha. Per day gross output
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Gender Unfriendly and expensive machines • Watermelon machines should be designed for easy start and operation. • Up-scaling should target all the gender • Affordability to all gender
Gender related opportunities	<ul style="list-style-type: none"> • Creates employment especially for youth • Reduces drudgery for women farmers as well as men
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Facilitation to access information • Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators

2.11.4 TIMP Name	Disc Harrow
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 Watermelon commodity


	<ul style="list-style-type: none"> • 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
<p>What is it? (TIMP description)</p>  <p>(Source; https://fonts.gstatic.com/s/i/productlogos/lens_camera/v1/192px.svg)</p>	<p>It is an implement consisting of a heavy frame set with teeth or tines which is dragged over ploughed land to break up clods, remove weeds, and cover seed and is a cultivating tool set with used primarily for breaking up and smoothing the soil in preparation of a seedbed for small sized grain planting.</p>
Justification	<p>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.</p>
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Watermelon farmers and researchers
Approaches to be used in dissemination	Field Demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	KALRO, Universities (for information) Machinery fabricators NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be up scaled	Nakuru, Bungoma, Trans Nzoia, Busia, Baringo
Challenges in dissemination	<ul style="list-style-type: none"> • Lack of machines • Lack of facilitation for demonstration • High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Acquisition of the machines • Lack of facilitation for demonstration • Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Mechanization in agriculture increases production • Mechanization releases labour to alternative requirement areas

	<ul style="list-style-type: none"> • Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in agricultural production • Include all gender groups in research, and validation. • Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 280,000
Estimated returns	6ha. Per day
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Gender Unfriendly and expensive machines • Watermelon machines should be designed for easy start and operation. • Up-scaling should target all the gender • Affordability to all gender
Gender related opportunities	<ul style="list-style-type: none"> • Creates employment especially for youth • Reduces drudgery for women farmers as well as men
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Facilitation to access information • Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators

2.11.5 TIMP Name	Multi-function seedbed ridging machine
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"> • Poor drainage during plant growth • Insufficient root growth

	<ul style="list-style-type: none"> • Poor root aeration • Poor infiltration
<p>What is it? (TIMP description)</p>  <p>(Source:https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.pinterest.ca%2Fpin%2Fhot-item-farm-equipment-bed-shapers-ridging-plough-for-cassava-planting--729231364655320466%2F&psig=AOvVaw07ThfN2eJvsQLDNITViRh5&ust=1666212915616000&source=images&cd=vfe&ved=0CA0QjRxqFwoTCMj45_nU6voCFQAAAAAdAAAAABAE)</p>	<p>Bed shapers with shaping disks form new beds from flat ground. One-pass "quick" bedding is conventional in easy-working soils. First prepare soil to seedbed condition with conventional tillage equipment. One-pass bedding can be done equally well in many soil types provided soil is tilled equally well. Needed tractor power primarily depends on bed height. A rugged, versatile, user-friendly equipment, we provide know-how to allow growers in all regions to take advantage of raised beds to grow better crops. Bed Shapers intelligently adapt to the local environment, local soil types and local tillage practices</p>
Justification	Machine seedbed ridging is uniform in tilth and height. It saves time in ridge formation of seedbeds, cheaper and enhances labour productivity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Watermelon Farmers and agribusiness entrepreneurs
Approaches to be used in dissemination	Field Demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Use by Farmers
Partners/stakeholders for scaling up and their roles	Machinery fabricators NGO supporting farmers(AGGRA)
C: Current situation and future scaling up	
Counties where already promoted if any	Non
Counties where TIMP will be up scaled	Baringo
Challenges in dissemination	<ul style="list-style-type: none"> • Relatively High cost for individual small-scale farmer. • Limited awareness of the existence of machine by the farming community.


Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Encourage group/cooperative ownership • Launch and awareness campaign through demonstrations and trainings • Encourage entrepreneurs to invest in equipment hire service
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Low scale of seedling production does not encourage use of a machine • There is lack of awareness about the machine • Has capacity to make a large number of beds within a short time
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. • Favourable on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	325,000 KES per unit
Estimated returns	2ha per day
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	Seedbed ridger was designed for easy attachment and operation. Men have been drawn to Watermelon planting 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
VMG issues and concerns in development, dissemination, adoption and scaling up	Facilitation to access information Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators

2.11.6 TIMP Name	Water Melon direct Sowing
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • Slow and tedious processes of seed placement • Difficult to prepare a uniform fine tilth seedbed manually • Delayed operation lead to late planting • High cost of manual labour
<p>What is it? (TIMP description)</p>  <p>https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.alibaba.com%2Fproduct-detail%2FChina-watermelon-seed-planting-and-cultivating_60849644071.html&psig=AOvVaw0UFG5O2HkLmodz2PiKzenh&ust=1666210503117000&source=images&cd=vfe&ved=0CA0QjRxqFwoTCPisyfvL6voCFQAAAAAdAAAAABAK</p>	<p>A Watermelon planter is a device used in agriculture that opens furrows meters, sow seeds for watermelons by positioning them in the soil and burying them to a specific depth without forming a ridge along the seed row. The watermelon planter sow seeds at the proper seeding rate and depth, ensuring that the seeds are covered by soil and a polythene paper that limits moisture evaporation and controls weeds</p>
Justification	<ul style="list-style-type: none"> • Manual planting increase the amount of seed used and increases labour cost as thinning may be required • Manual planting wastes fertilizer and seed • Fertilizer use is not evenly distributed when manually applied • Watermelon seed is small making planting depth critical and difficult to attain when manually done and seed shallowly planted will germinate with poor yields

	<ul style="list-style-type: none"> 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	Watermelon farmers, Universities, extension service providers and researchers
Approaches to be used in dissemination	Field Demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	KALRO, Universities (for information) Machinery fabricators NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Non
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Wajir, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> Lack of appropriate machines Lack of facilitation for demonstration High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Acquisition of the machines Lack of facilitation for demonstration Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	<ul style="list-style-type: none"> Mechanization in agriculture increases production Mechanization releases labour to alternative requirement areas Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> Creation of awareness on mechanization importance in agricultural production Include all gender groups in research, and validation. Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 280,000
Estimated returns	KES 60,000/ month gross income
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Gender Unfriendly and unaffordable machines Watermelon machines should be designed for easy start and operation. Up-scaling should target all the gender Affordability to all gender
Gender related opportunities	<ul style="list-style-type: none"> Creates employment especially for youth Reduces drudgery for women farmers as well as men


VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Facilitation to access information • Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires validation
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators

2.11.7 TIMP Name	Seedling tray planter
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"> • Tedious to plant in the trays manually • Manual planting is difficult to calibrate and may allow planting more than one seed in a hole • Manual seed try planting is time wasting



<p>What is it? (TIMP description)</p>  <p>(Source: https://s.alicdn.com/@sc04/kf/Hb4c358ebe1574892a7302c3e5c4f459cA.jpg_960x960.jpg)</p>	<p>For sowing seed that needs to be transplanted the machine is able to plant in trays without cells / box seeding, constantly feeding of the seed</p> <p>Speed of seed supply is adjustable; it has a belt of 400 cm long x 40 cm wide with brush for cleaning the top of the trays. The speed of the vibrating bowls is adjustable. Also you can adjust on the top side of the bowl the size of the seeds. The seeds fall down in a pipe that distributes the seeds over the output hoses.</p>
<p>Justification</p>	<ul style="list-style-type: none"> • Manual Watermelon seed tray planting can cover low acreage within a stipulated time and may delay due to bad weather • Manual planting labour dependency and require 20 people per hectare while a planter will require only 1 for the same time. • A part from lack of harvesting labour cost is saved by at least 70 percent
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Watermelon Farmers and agribusiness entrepreneurs</p>
<p>Approaches to be used in dissemination</p>	<p>Field Demonstrations, exhibitions, agricultural shows (ASK) and training</p>
<p>Critical/essential factors for successful promotion</p>	<p>Use by Farmers</p>
<p>Partners/stakeholders for scaling up and their roles</p>	<p>Machinery fabricators NGO supporting farmers (AGGRA)</p>
<p>C: Current situation and future scaling up</p>	
<p>Counties where already promoted if any</p>	<p>Non</p>
<p>Counties where TIMP will be up scaled</p>	<p>Baringo</p>
<p>Challenges in dissemination</p>	<ul style="list-style-type: none"> • Relatively High cost for individual small-scale farmer. • Limited awareness of the existence of machine by the farming community.
<p>Suggestions for addressing the challenges</p>	<ul style="list-style-type: none"> • Encourage group/cooperative ownership • Launch and awareness campaign through demonstrations and trainings

Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. • Favourable on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 360,000.00
Estimated returns	KES 200.00/tray (50-288cells)
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	Seed tray planter designed for easy start and operation. Men have been drawn to Watermelon threshing by the machine. This task was predominantly for women before the introduction of the machine.
Gender related opportunities	Creates employment at production, transportation, processing and distribution
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators
VMG related opportunities	Can create employment for VMG at local level

2.11.8 TIMP Name	Seedling trans planter
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"> • Tedious to trans plant from trays manually • Manual trans planting is difficult to calibrate and may injure the seedling • Manual seedling trans planting is time wasting


<p>What is it? (TIMP description)</p>	<p>It is designed for transplanting watermelon, melons, vegetable plants, flower plants, tobacco, nursery plants etc. with conical or cylindrical root balls up to 6 cm in diameter or cubic root balls up to 6cm, and also with the use of the relative equipment. They can also be used to seed courgettes etc. The transplanting units are independent, modular and adjustable for inter-row distance from a minimum of 50cm to a maximum of 90cm (other distances are available only on request). It is applicable to a tractor equipped with universal three-point linkage. It is capable of placing up to 3000 plants per hour each row.</p>
	
<p>(Source:https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.agrader.com.au%2Fitem%2Fagricultural-machinery%2Fseeder-planter%2Fnsw-fountaindale-2258%2Fhecchi-magli-wolf-d4-transplanter-209000&psig=AOvVaw0GQOOfmNJYVzafp2aDYzs&ust=1666213474899000&source=images&cd=vfe&ved=0CA0QjRxqFwoTCOC9xYTX6voCFQAAAAdAAAAABAM)</p>	
<p>Justification</p>	<ul style="list-style-type: none"> • Manual Watermelon seed trans planting can cover high acreage within a stipulated time and may enhance speed of planting to evade bad weather • Manual planting labour dependency and require 20 people per hectare while a planter will require only 1 for the same time. • A part from lack of harvesting labour cost is saved by at least 70 percent
<p>B: Assessment of dissemination and scaling up/out approaches</p>	
<p>Users of TIMP</p>	<p>Watermelon Farmers and agribusiness entrepreneurs</p>
<p>Approaches to be used in dissemination</p>	<p>Field Demonstrations, exhibitions, agricultural shows (ASK) and training</p>
<p>Critical/essential factors for successful promotion</p>	<p>Use by Farmers</p>
<p>Partners/stakeholders for scaling up and their roles</p>	<p>Machinery fabricators NGO supporting farmers(AGGRA)</p>
<p>C: Current situation and future scaling up</p>	
<p>Counties where already promoted if any</p>	<p>Non</p>
<p>Counties where TIMP will be up scaled</p>	<p>Baringo</p>

Challenges in dissemination	<ul style="list-style-type: none"> • Relatively High cost for individual small-scale farmer. • Limited awareness of the existence of machine by the farming community.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Encourage group/cooperative ownership • Launch and awareness campaign through demonstrations and trainings
Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. • Favourable on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 725,000
Estimated returns	4ha per day
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	Seed tray planter designed for easy start and operation. Men have been drawn to Watermelon threshing by the machine. This task was predominantly for women before the introduction of the machine.
Gender related opportunities	Creates employment at production, transportation, processing and distribution
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires validation
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Training on local use and transportation will make it more usable. • Watermelon harvester is affordable and could help VMGs exploit
VMG related opportunities	Can create employment for VMG at local level

2.11.9 TIMP Name	Water Melon Planter/weeder
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 seedling placement • Inconsistent planting depth and soil firming • Delayed operation lead to late planting • High cost of manual labour
<p>What is it? (TIMP description)</p>  <p>(Source:https://s.alicdn.com/@sc04/kf/HTB1qa1BXUvrK1RjSspcq6zzSXXaU.jpg_960x960.jpg)</p>  <p>(Source:https://www.dreamstime.com/stock-photo-watermelon-planting-crops-rows-background-plantation-grown-ground-covered-plastic-image85657161)</p>	<p>A watermelon seedling trans planter is a device used in agriculture that opens furrows meters, sow seedlings for watermelon by positioning them in the soil and burying them to a specific depth without forming a ridge along the seed row. The watermelon trans planter places seedlings at the proper seeding rate and depth.</p>
Justification	<ul style="list-style-type: none"> • Manual planting increase the amount of seed used and may require thinning


	<ul style="list-style-type: none"> Fertilizer use is not evenly distributed when manually applied Watermelon seedling is small making planting depth critical and difficult to attain when manually done and seedling shallowly planted will fail to pick 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	Watermelon farmers and researchers
Approaches to be used in dissemination	Field Demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	KALRO, Universities (for information) Machinery fabricators NGO supporting farmers for dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be up scaled	Nakuru, Bungoma, Trans Nzoia, Busia, Baringo
Challenges in dissemination	<ul style="list-style-type: none"> Lack of facilitation for demonstration High initial cost for small-scale machines
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Acquisition of the machines Facilitate demonstrations Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	<ul style="list-style-type: none"> Mechanization in agriculture increases production Mechanization releases labour to alternative requirement areas Provides low cost farm operations
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> Creation of awareness on mechanization importance in agricultural production Include all gender groups in research, and validation. Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 420,000
Estimated returns	2ha per day
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Gender Unfriendly and expensive machines Watermelon machines should be designed for easy start and operation. Up-scaling should target all the gender Affordability to all gender
Gender related opportunities	<ul style="list-style-type: none"> Creates employment especially for youth Reduces drudgery for women farmers as well as men

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Facilitation to access information Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> Demonstrations and training User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators

2.11.10 TIMP Name	Motorised Sprayer																																																																														
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 Tedious processes of manual spraying 																																																																														
What is it? (TIMP description)  <table border="1"> <thead> <tr> <th></th> <th colspan="5">Nozzle Guide for Broad and Directed Spraying</th> </tr> <tr> <th></th> <th>Cover Full Fan</th> <th>Two Even Flat Fan</th> <th>Half-Wave Cone</th> <th>Full Cone</th> <th>One and One Cone</th> </tr> </thead> <tbody> <tr> <td>Herbicides</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Pre-emergence</td> <td>Very Good</td> <td>Good</td> <td></td> <td>Good</td> <td></td> </tr> <tr> <td>Post-emergence Contact</td> <td>Good</td> <td>Very Good</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Post-emergence 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>Very Good</td> <td></td> <td>Good</td> <td>Very Good</td> </tr> <tr> <td>Systemic</td> <td></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>Very Good</td> <td>Very Good</td> <td>Very Good</td> <td></td> <td>Very Good</td> </tr> <tr> <td>Systemic</td> <td></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> (Source; Nasirembe, Katumani, 2021) (Source: https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.potato-grower.com%2F2018%2F06%2Fselecting-the-right-nozzles-for&sig=AOvVaw0yoH6Ga98Gjl0Y1Pk_1-)		Nozzle Guide for Broad and Directed Spraying						Cover Full Fan	Two Even Flat Fan	Half-Wave Cone	Full Cone	One and One Cone	Herbicides						Pre-emergence	Very Good	Good		Good		Post-emergence Contact	Good	Very Good				Post-emergence Systemic	Very Good	Good				Fungicides						Contact	Good	Very Good		Good	Very Good	Systemic					Good	Insecticides						Contact	Very Good	Very Good	Very Good		Very Good	Systemic					Good	Growth Regulators	Good			Very Good		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 e.g. as well as foliar fertilizers.
	Nozzle Guide for Broad and Directed Spraying																																																																														
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mu&ust=1666185100752000&source=i images&cd=vfe&ved=0CA0QjRxqFwo TCIC716rt6foCFQAAAAAdAAAAAB AE)	
Justification	Pest reduce yields up to 98% and are a major menace in agricultural production. Before watermelon forms a canopy, broad leafed weeds compete with watermelon seedling for nutrients and light greatly reducing their yield. Manual sprayer is labour intensive and spraying labour is too expensive. It has lower presser reducing its efficiency
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Watermelon Farmers and agribusiness entrepreneurs
Approaches to be used in dissemination	Field Demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Use by Farmers
Partners/stakeholders for scaling up and their roles	Machinery fabricators NGO supporting farmers(AGGRA)
C: Current situation and future scaling up	
Counties where already promoted if any	Non
Counties where TIMP will be up scaled	Baringo
Challenges in dissemination	<ul style="list-style-type: none"> • Relatively High cost for individual small-scale farmer. • Limited awareness of the existence of machine by the farming community.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Encourage group/cooperative ownership • Launch and awareness campaign through demonstrations and trainings
Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. • Favourable 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	3ha per day
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	Motorized sprayer designed for easy start and operation. Men have been drawn to spraying by the machine. This task was predominantly for women before the introduction of the machine.
Gender related opportunities	Creates employment at production, transportation, processing and distribution
Gender related opportunities	<ul style="list-style-type: none"> • Creates employment especially for youth • Reduces drudgery for women farmers as well as men

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Facilitation to access information • Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat, finger millet and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators

2.11.11 TIMP Name	Fertilizer spreader
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"> • Top up balance for nitrogen manually will not be uniformly distributed • Untimely spreading • High cost of labour • Low labour productivity
What is it? (TIMP description)	A broadcast fertilizer, alternately called a broadcaster, broadcast spreader or centrifugal fertilizer spreader, is a farm implement commonly used for spreading seed, lime, fertilizer, sand, ice melt, etc., and is an alternative to drop spreaders.
	

Justification	<ul style="list-style-type: none"> Manual fertilizer application can cover low acreage within a stipulated time and may delay Manual fertilizer application is labour dependent and require 20 people per hectare while a broadcaster will require only 1. A part from lack of fertilizer application cost is saved by at least 60 percent more than machine
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Watermelon Farmers and agribusiness entrepreneurs
Approaches to be used in dissemination	Field Demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Use by Farmers
Partners/stakeholders for scaling up and their roles	Machinery fabricators NGO supporting farmers(AGGRA)
C: Current situation and future scaling up	
Counties where already promoted if any	Non
Counties where TIMP will be up scaled	Nakuru, Bungoma, Trans Nzoia, Busia, Baringo
Challenges in dissemination	<ul style="list-style-type: none"> Relatively High cost for individual small-scale farmer. Limited awareness of the existence of machine by the farming community.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Encourage group/cooperative ownership Launch and awareness campaign through demonstrations and trainings
Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. Favourable on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Seed tray planter 125,000 KES per unit
Estimated returns	Capacity 500 Kg/ hour, Fuel 1 litre /hr (4-5 bags) Needs 3 operators per time Harvesting charges: KES 300 per bag Requires 1 season to return the KES 125,000 purchase price
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	Seed tray planter designed for easy start and operation. Men have been drawn to watermelon threshing by the machine. This task was predominantly for women before the introduction of the machine.
Gender related opportunities	Creates employment at production, transportation, processing and distribution
E: Case studies/profiles of success stories	

Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katamani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators

2.11.12 TIMP Name	Watermelon Harvesting
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • Late harvesting • Untimely harvesting • High cost of labour • Poor quality of produce due to injury • Loses due to part harvesting when workers get fatigued and some harvested watermelons are left on the farm
What is it? (TIMP description) 	Harvesting watermelon harvester is mostly done by hand and conveyed to a waiting trailer for shipment and grading. Melon are planted in rows leaving alleys for tractor tracks. A tractor mounted on to a trailer or two is driven into the plantation of ripe melons and a chain formed by human beings make a linkage of conveying detached melon to the trailer. The height of the trailer is 1.2m to avoid bottom placed fruits to crash against load due to piling
(Source: https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.alamy.com%2Fstock-photo%2Ftractor-farmer-field-	

watermelon.html&psig=AOvVaw3cf3GiTmmfq98rV94vyBpn&ust=1666214455662000&source=images&cd=vfe&ved=0CA0QjRxqFwoTCLj0qNja6voCFQAAAAAdAAAAABAE)	
Justification	<ul style="list-style-type: none"> • Manual watermelon harvesting can cover low acreage within a stipulated time and may delay bad weather • Manual harvesting is labour dependency and require 20 people per hectare while a watermelon harvester will require only 3. • A part from lack of labour harvesting cost is saved by at least 60 percent more than machine
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Watermelon Farmers and agribusiness entrepreneurs
Approaches to be used in dissemination	Field Demonstrations, exhibitions, agricultural shows (ASK) and training
Critical/essential factors for successful promotion	Use by Farmers
Partners/stakeholders for scaling up and their roles	Machinery fabricators NGO supporting farmers(AGGRA)
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be up scaled	Nakuru, Bungoma, Trans Nzoia, Busia, Baringo
Challenges in dissemination	<ul style="list-style-type: none"> • Relatively High cost for individual small-scale farmer. • Limited awareness of the existence of machine by the farming community.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Encourage group/cooperative ownership • Launch and awareness campaign through demonstrations and trainings
Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. • Favourable on cost of agricultural mechanization
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 450,000.00
Estimated returns	12ha per day
Gender issues and concerns in development ,dissemination, adoption and scaling up	Gender Unfriendly and expensive machines Watermelon machines should be designed for easy start and operation. Up-scaling should target all the gender Affordability to all gender
Gender related opportunities	Creates employment especially for youth

	Reduces drudgery for women farmers as well as men
VMG issues and concerns in development, dissemination, adoption and scaling up	Facilitation to access information Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat and rice
Application guidelines for users	<ul style="list-style-type: none"> • Demonstrations and training • User manuals
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires further research
G: Contacts	
Contacts	The Institute Director, KALRO AMRI –Katumani; P.O. Box 340. Machakos Email: cd.katumani@kalro.org Phone: 0711369535
Lead organization and scientists	KALRO Nasirembe W,W, 0733812953
Partner organizations	Agricultural machinery dealers, suppliers, parts stockists, Fabricators
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Training on local use and transportation will make it more usable. • Watermelon harvester is affordable and could help VMGs exploit
VMG related opportunities	Can create employment for VMG at local level

2.12 Agricultural Business and Marketing

2.12.1 TIMP Name	Models for market-oriented production of watermelon
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of drivers of watermelon production leading to market inaccessibility. (produce, look for market and sell)
What is it? (TIMP description)	An approach to organize watermelon 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	Without appropriate approaches in the organization of watermelon production, farmers will lack markets, leading to the decline in production and income. Market based strategies reduce the market intermediaries and bring consumers nearer to the producer.
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
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Acceptance of smallholder farmers to produce watermelon • Availability of investors • Better/ guaranteed higher prices of watermelon
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – investments in watermelon production • County extension staff - Organization of farmers and technical service delivery • NGOs – Organization of farmers and service delivery • Private sector (local traders and exporters) – Support in input services and providing markets for the watermelon production • Research institutions – Availing improved seeds, backstopping
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMPs will be up scaled	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Group dynamics • Limited investment by buyers • Prices of watermelon • Level of policy support •

Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of marketing groups • Small-scale farming – Aggregation of production • Group dynamics – Capacity building • Limited investment by buyers – County government support • Prices of watermelon – Setting minimum price • Level of policy support – price policy, subsidies, inputs support, standardization in price/weights aspect
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Production of watermelon without agreed buyers • 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 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 watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 22000.00
Estimated returns	<ul style="list-style-type: none"> • An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed. Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100.
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

	<ul style="list-style-type: none"> • Strict rules of entry and requirements of producers' organizations may limit women participation
Gender related opportunities	<ul style="list-style-type: none"> • Men and youth stand to benefit with higher profit margins through collective bargaining during marketing
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> • VMGs are widely discriminated in rural producer organizations • VMGs also have limited participation and influence in rural producer organizations • Limited access to assets, resources and services, required to join producer groups
VMG related opportunities	<ul style="list-style-type: none"> • VMGs stand to benefit with higher profit margins through collective bargaining and marketing • Opportunities exist for unemployed youth in production and marketing through ICT
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Ready for upscaling
G: Contacts	
Contacts	Dr. Wambua, J.M. and Mr. Ndungu J. M.
Lead organization and scientists	KALRO-AMRI– Katumani and KALRO _HRI Thika
Partner organizations	<ul style="list-style-type: none"> • MoALF,

Research Gaps

1. Efficiency evaluation of the farmer-market linking models
2. Equity distribution among the producers
3. Productivity levels among the smallholder farmers due to farmer-market linking models
4. Farmer accessibility to production inputs

2.12.2 TIMP Name	Developing a Business Plan for watermelon farm Business
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low management and lack of sustainability and success in watermelon farming business due to lack of business plans.
What is it? (TIMP description)	A watermelon business plan will serve as an internal management and organizing tool, which can be used to communicate outside your business, or both?
Justification	With a business plan in hand, watermelon farmers and rural entrepreneurs will be able to take that first step toward the creation of a successful and sustainable business.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, traders and processors
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"> • Education levels of the farmers and investors in watermelon production • Levels of experiences in watermelon production • Availability of information on watermelon production and marketing
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 watermelon • Research institutions – Capacity building • Financial Institutions – Financial support
C: Current situation and future scaling up	
Counties where already promoted if any	<ul style="list-style-type: none"> • None
Counties where TIMPs will be up scaled	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming

	<ul style="list-style-type: none"> • Inadequate information to stakeholders on watermelon production and marketing • Low levels of policy support • 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 watermelon production – Developing information hub • Level of policy support – support in extension services • Levels of education – Capacity building
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Low adoption of business planning
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Acceptable in Counties growing watermelon • Environmental conditions – Availability of water resources, • Policy conditions – Policy support in opportunities selected
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 22000.00
Estimated returns	<ul style="list-style-type: none"> • An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed. Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100.
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	<ul style="list-style-type: none"> None
Application guidelines for users	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> Ready for upscaling
G: Contacts	
Contacts	Dr. Wambua, J.M. and Mr. Ndungu J. M.
Lead organization and scientists	KALRO-AMRI-Katumani and KALRO _HRI Thika
Partner organizations	<ul style="list-style-type: none"> Ministry of Agriculture at the county level NGOs FBOs Public Private sector Partnerships

Research Gaps

1. Impact of business plan on watermelon production
2. Adoption of business plan

2.12.3 TIMP Name	Marketing as a group - collective marketing
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Individual farmer marketing increases inaccessibility to markets due to low volumes and 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 inaccessibility.
Justification	Due to small-scale farming of watermelon, marketing as a group would enable farmers to gain from economies of scale. The

	advantages of collective marketing are bigger volumes, uniform quality, reliable sellers, reliable buyers, continuous supply, 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 • Sell their produce before the collective sale • The farmer is not able to deliver the agreed amount to the group • Side-selling • Bad weather • Variable quality
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	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on watermelon production and marketing • undefined production programmes of watermelon • Levels of policy support • Haphazard pricing of the fruits lack of standardized quantification
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 watermelon production – Developing information hub • Defining production programmes of watermelon – SWOT analysis • Level of policy support – support in extension services

	<ul style="list-style-type: none"> Standardized pricing per weight (kg)
Lessons learned in up scaling if any	<ul style="list-style-type: none"> Commitment: low commitment 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 – lack of trust among members Environmental conditions – unfavourable condition for watermelon production Policy conditions – lack of Infrastructural support (inputs, subsidies, marketing price guaranteed systems)
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 22000.00
Estimated returns	<ul style="list-style-type: none"> An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed. Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100.
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> Women are widely discriminated in rural producer organizations Women also have limited participation and influence in rural producer organizations Socio-cultural norms may limit women's participation and leadership in groups Women's double and triple roles means they may not have time to participate Women's status, age, wealth level may influence participation Limited access to assets, resources and services, required to join producer groups In some cultures women may not be able to travel away from their homes to producer group meetings, without permission Strict rules of entry and requirements of producers' organizations may limit women participation
Gender related opportunities	<ul style="list-style-type: none"> Men and youth stand to benefit with higher profit margins through collective bargaining during marketing
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> VMGs are widely discriminated in rural producer organizations VMGs also have limited participation and influence in rural producer organizations

	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> Ready for upscaling
G: Contacts	
Contacts	Dr. Wambua, J.M. and Mr. Ndungu J. M.
Lead organization and scientists	KALRO-AMRI-Katumani and KALRO _HRI Thika
Partner organizations	<ul style="list-style-type: none"> Farmers – Defining production programme County extension staff - Capacity building NGOs – Capacity building

Research Gaps

1. Profitable opportunities.
2. Performance of marketing as a group

2.11.4 TIMP Name	Profitability analysis - Reviewing performance of watermelon agro-enterprise
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of profitability analysis by farmers, leading to lack of comparison of costs and returns and therefore 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 watermelon agro-enterprise
Justification	Profitability analysis reviews the management success and sustainability of the watermelon business. It indicates areas of adjustment
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
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Record keeping of costs and returns • Ability of farmers to keep records
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – 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 promoted if any	-
Counties where TIMPs will be up scaled	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Inability of farmers to keep records • Lack of clear documentation on the cost of production • Use of non-costed family labour in watermelon production
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Inability of farmers to keep records – capacity building • Cost of production- capacity building • Use of non-costed family labour in watermelon production – capacity building on how to cost family labour
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – Awareness on record keeping • Environmental conditions – suitable for the increased production of watermelon • Policy conditions – Policy support in costs of inputs and prices of outputs

	<ul style="list-style-type: none"> Market conditions – Higher prices than costs
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 22000.00
Estimated returns	<ul style="list-style-type: none"> An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed. Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100.
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	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> Ready for upscaling
G: Contacts	
Contacts	Dr. Wambua, J.M. and Mr. Ndungu J. M.
Lead organization and scientists	KALRO-AMRI-Katumani and KALRO _HRI Thika
Partner organizations	

Research Gaps

1. Investigation on strategies to reduce costs of production of watermelon.
2. Investigation on price increasing strategies

2.12.5 TIMP Name	Scaling up plan of watermelon agro-enterprise development approach
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Identifying the appropriate scaling method for the watermelon agro-enterprise development. What the farmer group can do to scale up their production of watermelon. Increasing production from increasing size of existing group, 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 to add new groups. 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	<ul style="list-style-type: none"> • Farmers, traders and processors
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"> • Can the farmers increase production within their group • How will the farmers increase their production and sales (more technology, more land, more members) • Can the farmers work with other existing groups (available/not available) • Do the farmers need to form new groups
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

	<ul style="list-style-type: none"> • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	<ul style="list-style-type: none"> • None
Counties where TIMPs will be up scaled	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Issues related to increasing production from existing group • Issues related to increasing production from increasing size of existing groups
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Issues related to increasing production from existing group – farmers reach their new production target from the group members and farmers investing in new technology to achieve new targets • Issues related to increasing production from increasing size of existing groups – the first group help new farmers to develop an enterprise plan and the new farmers to join the existing groups or form an associated group
Lessons learned in up scaling if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> • Social conditions – are there other farmers who want to join the group • Environmental conditions – would the increase in production come from improved technology, more land, or new members in the group • Policy conditions – Policies supporting formation and functioning of producer organizations • Market conditions – new markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 22000.00
Estimated returns	<ul style="list-style-type: none"> • An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed. Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100. Selling to neighbouring countries like Uganda at a higher price of between Kshs and Kshs per watermelon

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	-
Application guidelines for users	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	Dr. Wambua, J.M. and Mr. Ndungu J. M.
Lead organization and scientists	KALRO-AMRI-Katumani and KALRO _HRI Thika
Partner organizations	<ul style="list-style-type: none"> • Farmers – Defining production programme • County extension staff - Capacity building • NGOs – Capacity building

Research Gaps

1. Processes in scaling up agro-enterprise development approach and production.
2. Effects of scaling up plan

2.12.6. TIMP Name	Contracted Watermelon production model
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Market failure in Watermelon production has led to low price, low production and poor quality
What is it? (TIMP description)	Contract farming involves private companies extending lines of credit to producers in the form of farming inputs and technical assistance. Under contract farming terms, contractors commit themselves to buy the entire product at an agreed price. On the other hand, producers avail desired produce for sale.
Justification	<p>Without contract farming smallholder farmers realize low prices for their produce.</p> <p>Contract farming is a contractual arrangement between producers and buyers of a farm product. The contract can either be oral or written, and will specify one or more conditions of production and marketing of an agricultural product.</p> <p>In essence, contract farming commits the farmer to produce a certain commodity at a certain time for an agreed price and, in return, the contractor undertakes to buy the commodity, and may provide agricultural extension and other services to producers in order to satisfy production requirements in terms of quality and quantity.</p> <p>The benefits of contract farming to farmers are market access, increased Incomes, reduction in the risk of price fluctuations, credit and financial intermediation, timely provision of inputs, monitoring and labour incentives, reduction of production risk, introduction of higher-value crops, improved collective bargaining, household spill-over benefits and improved access to extension. A written contract farming is recommended.</p>
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
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Willing farmers • Availability of traders • Competitiveness of Watermelon • Production volume • Enforcement and bidding contract farming
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Contract party and beneficiaries • County extension staff - Capacity building, signing 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	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Lack of information by part of the 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 • Lack of information by part of the producers – Capacity building • Level of policy support – County policy formulation and enforcement for contract farming
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Increased benefits
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 – reduced environmental pollution through safe use of agro-chemicals, Input support in the contract improves natural resource management • Policy conditions – Policy in formulation and enforcement

	<ul style="list-style-type: none"> Market conditions – volume, place, price, promotion, traders
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 22000.00
Estimated returns	<ul style="list-style-type: none"> An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed. Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100.
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	-
Application guidelines for users	<ul style="list-style-type: none"> Training factsheets, manuals and power point slides
F: Status of TIMP Readiness (1. Ready for up scaling, 2, Requires validation, 3. Requires further research)	<ul style="list-style-type: none"> Ready for upscaling
G: Contacts	
Contacts	Dr. Wambua, J.M. and Mr. Ndungu J. M.
Lead organization and scientists	KALRO-AMRI-Katumani and KALRO _HRI Thika
Partner organizations	<ul style="list-style-type: none"> Farmers – Defining production programme County extension staff - Capacity building

	<ul style="list-style-type: none"> • NGOs – Capacity building
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Research Gaps

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

2.12.7. TIMP Name	Watermelon marketing entrepreneurship model
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Farmers' failure to apply entrepreneurship while marketing watermelon leading to low prices
What is it? (TIMP description)	An entrepreneur farmer undertake innovations and finance and business acumen in an effort to transform innovations into economic goods and ultimately profit.
Justification	Farmers become entrepreneurs when business principles are applied in farming practices to make businesses successful. 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
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Organization of farmers • Availability of innovations • Achievement of profit • Access to finance • Availability of facilitators • Availability of many traders • Production volume and quality
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Acceptability of innovations • County extension staff - Facilitators • NGOs – Facilitators • Private sector (local traders and exporters) – Buyers

	<ul style="list-style-type: none"> • Research institutions – Facilitators
C: Current situation and future scaling up	
Counties where already promoted if any	<ul style="list-style-type: none"> • None
Counties where TIMPs will be up scaled	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Small-scale farming • Availability of information • Profitability in Watermelon farming • 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 learned in up scaling 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 methods • 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	<ul style="list-style-type: none"> • The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 22000
Estimated returns	<ul style="list-style-type: none"> • An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed. Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100. Selling to neighbouring countries like Uganda at a higher price of between Kshs and Kshs per watermelon
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 • Women do not know how to save their money that can be used in entrepreneurship compared with men

	<ul style="list-style-type: none"> 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. Uweso fund etc.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<ul style="list-style-type: none"> Increased income and diversification in investments
Application guidelines for users	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> Ready for upscaling
G: Contacts	
Contacts	Dr. Wambua, J.M. and Mr. Ndungu J. M.
Lead organization and scientists	KALRI_AMRI-Katumani and KALRO _HRI Thika
Partner organizations	

Research Gaps

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

2.11.8. TIMP Name	Internet/online/mobile marketing
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> 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
What is it? (TIMP description)	Internet marketing refers to the strategies used to market products and services online and through other digital means. These can include a variety of online platforms, tools, and content delivery systems
Justification	Internet marketing is increasingly becoming mandatory for businesses of all types. This high adaptability of internet marketing is an important benefit that businesses can take advantage of to provide their consumers with the best shopping experience. Consumers use a variety of online methods for finding, researching, and eventually making purchasing decisions. Internet marketing reduces costs.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	<ul style="list-style-type: none"> • Farmers, traders and processors
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"> • Education levels of the farmers and investors in Watermelon production and profitability analysis • Levels of experiences in Watermelon production • Availability of information on Watermelon production and marketing
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Sellers of Watermelon production • County extension staff - Capacity building • NGOs – Capacity building • Private sector (local traders and exporters) – Buyers of Watermelon • Research institutions – Capacity building
C: Current situation and future scaling up	
Counties where already promoted if any	-
Counties where TIMPs will be up scaled	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Low digital skills of farmers • Unconsolidated produce for the market • Small-scale farming

	<ul style="list-style-type: none"> • Inadequate information to stakeholders on the Watermelon production and marketing and profitability • Internet connectivity • Levels of policy support on internet infrastructure
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Low digital skills of farmers – capacity building • Unconsolidated produce for the market – Delivery of produce to the designated centres • Small-scale farming – capacity building and sensitization to appreciate need for consolidation of produce • Inadequate information to stakeholders on the Watermelon production and marketing and profitability - Developing information hubs • Internet connectivity – Information hubs • Level of policy support – Policy support in internet infrastructure and utilization
Lessons learned in up scaling 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	<ul style="list-style-type: none"> • The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 22000 (F1)
Estimated returns	<ul style="list-style-type: none"> • An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed. Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100.
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	-
Application guidelines for users	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Ready for upscaling
G: Contacts	
Contacts	Dr. Wambua, J.M., and Mr. Ndungu J. M
Lead organization and scientists	KALRO-AMRI-Katumani and KALRO _HRI Thika
Partner organizations	

Research Gaps

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

2.13 Agricultural Policy Options

2.13.1 TIMP Name	National Agricultural policy framework for smallholder farmers of watermelon
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • 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. Indeed, they are considered to have little agency beyond the adoption of modernising innovations that are believed to transform agriculture and build livelihoods.
What is it? (TIMP description)	National Agricultural policy framework includes policies that have framed smallholder farmers, providing policy objectives and instruments.
Justification	Agricultural policy making in Kenya overlook diverse agricultural transformation pathways that are sustainable in local social/material conditions and based on smallholder farmers' knowledge's leading to the unmet stated objectives of policy, to reduce poverty by building smallholder livelihoods and increasing agricultural productivity, are not met. 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, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of stakeholders • Availability of specific watermelon-based policies
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Demanding watermelon policies to support production and marketing • County extension staff - Sensitization of farmers • NGOs – Sensitization of farmers • Private sector (local traders and exporters) – Demanding watermelon 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	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and	<ul style="list-style-type: none"> • Value Chain: watermelon yields remain low and total domestic production is unable to satisfy demand by

<p>dissemination -</p>	<p>manufacturers leading to growing imports of raw materials.</p> <ul style="list-style-type: none"> • Standards: Existing standards at the production level are poorly defined and implemented, and largely do not include environmental or CSA criteria. Voluntary certifications are piecemeal and not widely adopted. • Aggregation: Aggregation models including cooperatives— are limited. Farmers tend operate individually and not as a group. These weak organizations provide few services to farmers while providing limited bargaining power. • Financial Incentives: The government provides only limited support to watermelon producers through subsidized seed, irrigation infrastructure, and research. Meanwhile the bulk of financial incentives, including tax breaks, exemption from import duties, and subsidized electricity, target apparel manufacturers downstream in the value chain, primarily those in Export Processing Zones (EPZs). Some private companies are investing backward in their supply chains to increase farmer production by entering purchase contracts, financing access to inputs, and importing their own hybrid seed. However, none of these efforts are explicitly tied to environmental or CSA standards.
<p>Suggestions for addressing the challenges</p>	<ul style="list-style-type: none"> • Value Chain: Enhance productivity and total production through better seeds, irrigation, and CSA management practices. Develop targeted incentives to encourage stronger engagement of producers by downstream actors. • Standards: Existing watermelon standards and classifications should be redesigned to align with Kenya’s climate-smart agriculture strategy, in coordination with relevant institutions across the sector. Farmer cooperatives should receive public support to promote and enable higher quality production through input access and CSA extension training. • Aggregation: Partnerships between farmer cooperatives and watermelon producers can strengthen market linkages, set guaranteed prices for farmers, and enable access to resilient, high-yielding seeds and other climate-smart inputs. • 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 may opt to continue its efforts to implement quality-based

	watermelon payments, including CSA-criteria, while offering comprehensive service provision for producers through public-private partnerships. Building public-private partnerships is key to filling service Research Gaps for smallholders to improve productivity and disseminate CSA practices.
Lessons learned in up scaling if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Traditional farming of watermelon where there is no value chain • Environmental conditions – Use of pesticides • Policy conditions – Lacking specific watermelon policy • Market conditions - Poor market infrastructure
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 3500
Estimated returns	<ul style="list-style-type: none"> • An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed (variety). Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100. Selling to neighbouring countries like Uganda likely to double the profit of watermelon
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	<ul style="list-style-type: none"> • Training factsheets, manuals and power point slides
F: Status of TIMP Readiness (1. Ready for up scaling, 2, Requires validation, 3. Requires further research)	<ul style="list-style-type: none"> • Requires validation and upscaling
G: Contacts	
Contacts	Mr. Ndungu J. M and Dr. Wambua, J.M.
Lead organization and scientists	KALRO- HRI Thika and AMRI-Katumani
Partner organizations	<ul style="list-style-type: none"> • Farmers – Defining production programme • County extension staff - Capacity building • NGOs – Capacity building

Research Gaps

- 1 Adoption of policies
- 2 Equity distribution among the stakeholders
- 3 Productivity levels among the smallholder farmers of watermelon
- 4 Farmer accessibility to production inputs
- 5 Impact on watermelon prices

2.13.2 TIMP Name	Policy options and objectives related to watermelon farming
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Market failure in influencing the behaviour in watermelon production and marketing
What is it? (TIMP description)	A policy towards the agricultural sector as a whole, or towards one particular interest group such as food consumers, grain producers, watermelon producers or fertilizer manufacturers can be characterised as consisting of three sets of elements; objectives, instruments of policy and rules for operating instruments of policy.
Justification	Agricultural policies for supporting watermelon output are based at farm and market levels. The policy objective is to increase watermelon output. The policy instruments chosen

	might be raise the price of watermelon received by producers, such as an import tax or a production subsidy, an instrument to reduce the cost of grain production such as an input subsidy or capital grant and an instrument which reduces returns to products which compete watermelon for land, thus causing substitution of resources into watermelon production.
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, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of stakeholders • Availability of agricultural policies and specific watermelon-based policies • Issues in watermelon business • Specific policy objective statement
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Farmers – Demanding watermelon policies to support production and marketing • County extension staff - Sensitization of farmers • NGOs – Sensitization of farmers • Private sector (local traders and exporters) – Demanding watermelon 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	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the agricultural policies whether National or County • Poorly established watermelon value chain • watermelon production are specific to agro-ecological zones and not all the Counties in Kenya grow watermelon
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organizations as an institution

	<ul style="list-style-type: none"> • Small-scale farming – Policies for increasing productivity • Inadequate information to stakeholders on the agricultural policies whether National or County – Sensitization of stakeholders • Poorly established watermelon value chain – strengthening watermelon value chain • watermelon production are specific to agro-ecological zones and not all the Counties in Kenya grow watermelon – Diversification of watermelon
Lessons learned in up scaling if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Acceptability of the policies • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Lacking specific watermelon policy • Market conditions - Poor market infrastructure
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 3500
Estimated returns	<ul style="list-style-type: none"> • An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed (variety). Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100. Selling to neighbouring countries like Uganda at a higher price of between Kshs and Kshs per watermelon
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	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	Mr. Ndungu J. M and Dr. Wambua, J.M.
Lead organization and scientists	KALRO- HRI Thika and AMRI-Katumani
Partner organizations	<ul style="list-style-type: none"> • Farmers – Defining production programme • County extension staff - Capacity building • NGOs – Capacity building

Research Gaps

1. Adoption of policy options
2. Equity distribution among the stakeholders
3. Productivity levels among the smallholder farmers
4. Farmer accessibility to production inputs

2.13.3 TIMP Name	Instruments of policy related to watermelon
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Failure to achieve policy objectives due lack of instruments related to the 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 of forms. It is very likely that a particular policy instrument, although designed to have primarily an efficiency,

	distributive, or stability effect, will also have some impact on the other objectives
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, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of policy objectives • Availability of policy instruments
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	-
Counties where TIMPs will be up scaled	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on the agricultural policies whether National or County • Poorly established watermelon value chain • watermelon production are specific to agro-ecological zones and not all the Counties in Kenya grow watermelon
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – Formation of producer organizations as an institution • Small-scale farming – Policies for increasing productivity • Inadequate information to stakeholders on the agricultural policies whether National or County – Sensitization of stakeholders • Poorly established watermelon value chain – strengthening watermelon value chain

	<ul style="list-style-type: none"> watermelon production are specific to agro-ecological zones and not all the Counties in Kenya grow watermelon – Diversification of watermelon
Lessons learned in up scaling if any	<ul style="list-style-type: none"> None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> Social conditions – Low understanding of policy instruments Environmental conditions – lack of a comprehensive land use policy Policy conditions – Lacking specific watermelon policy Market conditions - Poor market infrastructure
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 3500
Estimated returns	<ul style="list-style-type: none"> An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed (variety). Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100. Selling to neighbouring countries like Uganda at a higher price of between Kshs and Kshs per watermelon
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	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	Mr. Ndungu J. M and Dr. Wambua, J.M.
Lead organization and scientists	KALRO- HRI Thika and AMRI-Katumani
Partner organizations	<ul style="list-style-type: none"> • Farmers – Defining production programme • County extension staff - Capacity building • NGOs – Capacity building

Research Gaps

1. Validation of policy instruments
2. Equity distribution among the stakeholders
3. Farmer accessibility to production inputs markets.
4. Farmers' accessibility to output market

2.13.4 TIMP Name	Policy cycle for smallholders' policy issues and implementation
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • 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 watermelon? 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 frame work and antedates any forthcoming issues related to policy development
What is it? (TIMP description)	The policy cycle is usually divided into five stages: agenda setting, formulation, implementation, and evaluation
Justification	The policy cycle creates the need for a policy based on the agricultural problem emergence/issues. The policy cycle is an idealised 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

	<p>process, but many organisations aim to complete policies using the policy cycle as an optimal model. Policy cycle is a valuable device for new policy development. It is a tool which divides complex procedures into convenient and manageable steps. ... These steps are flexible enough to incorporate any changes at the time of new policy development and as a part of continuous change once it is implemented.</p>
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
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of stakeholders • The stages of problem emergence, formulation, implementation and evaluation
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	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Inadequate information to stakeholders on issues • Poorly established watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – issues on formation of producer organizations as an institution • Small-scale farming – issues on aggregation • Inadequate information to stakeholders – Sensitization on the roles of each policy cycle stages • Poorly established watermelon value chain – strengthening watermelon value chain

Lessons learned in up scaling if any	<ul style="list-style-type: none"> • None
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – Different issues among the watermelon producers • Environmental conditions – environmental issues • Policy conditions – Lacking specific watermelon policy • Market conditions – Market issues
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 3500
Estimated returns	<ul style="list-style-type: none"> • An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed (variety). Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100.
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	<ul style="list-style-type: none"> • Training factsheets, manuals and power point slides are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2,	<ul style="list-style-type: none"> • Requires validation

Requires validation, 3. Requires further research)	
G: Contacts	
Contacts	Mr. Ndungu J. M and Dr. Wambua, J.M.
Lead organization and scientists	KALRO- HRI Thika and AMRI-Katumani
Partner organizations	

Research Gaps

1. Analysis of policy model.
2. Impact on the new policy on watermelon production and marketing

2.13.5 TIMP Name	Policy validation cycle for policy customization
Category (i.e. technology, innovation or management practice)	<ul style="list-style-type: none"> • Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	High costs in making a new policy relevant to watermelon production 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, Research institutions
Approaches to be used in dissemination	<ul style="list-style-type: none"> • Meetings, radio, TV, social media (WhatsApp, Facebook, twitter), internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of stakeholders • Availability of agricultural policies
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	<ul style="list-style-type: none"> • Machakos, Kajiado and the coastal region are popular watermelon growers
Challenges in development and dissemination -	<ul style="list-style-type: none"> • Disorganization and scattered farmers • Small-scale farming • Poorly established watermelon value chain
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Disorganization and scattered farmers – information on application of the policy • Small-scale farming – information on production levels • Poorly established watermelon value chain – strengthening watermelon value chain
Lessons learned in up scaling if any	-
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> • Social conditions – lack of information • Environmental conditions – lack of a comprehensive land use policy • Policy conditions – Lacking specific watermelon policy • Market conditions – lack of information
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	<ul style="list-style-type: none"> • The cost of producing watermelons is low, one acre of land may require about Kshs 40,000. A kilogram of seeds costs about Kshs 3500
Estimated returns	<ul style="list-style-type: none"> • An acre of land can produce over 15,000 fruits, each weighing between 8 kg to 12 kg or more, depending on the breed (variety). Let's say you produce 13,000 watermelons during the first harvest, you can easily make Kshs 1,300,000 if you sell each at Kshs 100. Selling to neighbouring countries like Uganda at a higher price of between Kshs and Kshs per watermelon
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 frame to support their participation
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Requires validation
G: Contacts	
Contacts	Mr. Ndungu J. M and Dr. Wambua, J.M.
Lead organization and scientists	KALRO- HRI Thika and AMRI-Katumani
Partner organizations	<ul style="list-style-type: none"> • Farmers – Defining production programme • County extension staff - Capacity building • NGOs – Capacity building

Research Gaps

1. Impact of validated policies



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