



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



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## **DISCLAIMER**

The information presented in this inventory of Technologies, Innovations and Management Practices (TIMPs) book is for advisory use only. Users of this book should verify site specific details that relate to their 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 the development, validation, adoption and delivery of context specific climate smart agriculture (CSA) technologies, innovation and management practices (TIMPs). It is also responsible for development of sustainable seed production and distribution systems of priority agricultural value chains to enhance availability and access improved seeds, animal breeds and fingerlings by target beneficiaries. Against this background, KALRO and her National Agricultural Research System (NARS) partners have developed, validated and availed CSA TIMPs for dissemination and adoption. This document provides a detailed inventory of TIMPs that have been developed in tomato value chain.

Extensive information from research and background data has been used to develop this TIMPs inventory. To disseminate the TIMPs, a Training of Trainers (ToT) manual has been developed. The design of the manual takes into consideration the delivery system, partners and their roles, duration of training and logical flow of the modules. The training modules have uniform outline that ensures every aspect of the TIMPs are fully covered in way that the trainees can absorb and relate to. Various delivery methods are deployed and where possible demonstrations and practical work are incorporated to enable the trainees learn by participating in the actual field activities. The use of this TIMPs inventory is expected to contribute to achievement of the envisaged KCSAP's project 'Triple Wins' of increased productivity, enhanced resilience and reduction of greenhouse gases emissions. Thus, this TIMPs inventory is to be used in conjunction with the respective tomato ToT Manual.

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

Eliud K. Kireger, PhD, OGW  
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## **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 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.

To catalyze 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 mango), cereals (sorghum, millet, maize, teff) nuts (mango nut), fruits (banana, mango, water melon) 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, 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 responsibility 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. Use of these information resources coupled with the accompanying training and contribution of the other project components will go a long way in enabling KCSAP to meet its development objectives.

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

Francis Muthami

**National Project Coordinator**

**Kenya Climate-Smart Agriculture Project**

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## **ABBREVIATIONS AND ACRONYMS**

AAK	Agrochemicals Association of Kenya
ADSP	Agriculture Sector Development Support Programme
AFA	Agriculture and Food Authority
AIPs	Agricultural Innovation Platforms
ASALs	Arid and Semi-Arid Lands
ASK	Agriculture Society of Kenya
CABI	Center for Agriculture and Bioscience International
CBO	Community based organization
CIGs	Common Interest Groups
CGIAR	Consultative Group for International Agricultural Research
CoG	Council of Governors
CSA	Climate Smart Agriculture
FFBS	Farmer Field and Business Schools
FPC	Fresh Produce Consortium
FPEAK	Fresh Produce Exporters Association of Kenya
FSMS	Food Safety Management System
GAP	Good Agricultural Practice(s)
GHP	Good Hygiene Practice
GHG	Greenhouse Gas
GMP	Good Manufacturing Practice
HACCP	Hazard Analysis and Critical Control Points
IGA	Income Generating Activity
ICM	Integrated Crop Management
ICRAF	International Centre for Research in Agroforestry
IPR	Intellectual Property Rights
IPM	Integrated Pest Management
ISFM	Integrated Soil Fertility Management
JICA	Japan International Cooperation Agency
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KALRO	Kenya Agricultural & Livestock Research Organization
KCSAP	Kenya Climate Smart Agriculture Project
KEFRI	Kenya Forestry Research Institute
KEPHIS	Kenya Plant Health Inspectorate Service
KES	Kenya Shilling
KIRDI	Kenya Industrial Research and Development Institute
KOPIA	Korea Project on international agriculture
MIAC	MidAmerica International Agricultural Consortium
MoALF&C	Ministry of Agriculture, Livestock, Fisheries and Cooperatives
MRLs	Maximum Residue Levels
NACOSTI	National Commission for Science, Technology and Innovation
NARS	National Agricultural Research System
NGOs	Non-Governmental Organization
NPT	National Performance Trials
PDO	Project Development Objective
PCPB	Pest Control Products Board
ROI	Return on Investment

SACDEP	Sustainable Agriculture Community Development Programmes
TIMP	Technology, Innovation and Management Practices
ToTs	Training of Trainers
USAID	United States Agency for International Development
TYLCV	Tomato Yellow Leaf Curl Virus
TMV	Tomato Mosaic Virus
VMGs	Vulnerable and Marginalized Groups

## 1.0 DEFINITION OF TERMS AND SUMMARY TABLES OF TOMATO TIMPS

### 1.1 Definition of terms

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

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

**Innovation:** This is defined as a modification of 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 Tomato Value Chain

The inventory process resulted in a total of 100 TIMPs including 48 technologies, 6 innovations and 46 management practices, distributed among the 13 sub-themes, as indicated in Table 1.

**Table 1. TIMPS in the Tomato Value Chain**

Commodity/VC	Sub-Theme	Technologies	Innovations	Management Practices
Tomato	Improved varieties	13	0	0
Tomato	Seed systems	1	0	1
Tomato	Agronomic practices	2	0	2
Tomato	Natural resource management	4	2	4
Tomato	Physiological Disorders	1	0	1
Tomato	Pests and diseases	3	1	18
Tomato	Weeds	3	2	4
Tomato	Food safety and GAP	0	0	2
Tomato	Harvesting and postharvest handling	6	0	2
Tomato	Value addition	5	0	0
Tomato	Mechanization	10	1	0
Tomato	Business and Marketing	0	0	8
Tomato	Policy	0	0	4
<b>Overall Total</b>		<b>48</b>	<b>6</b>	<b>46</b>

### 1.3 Summary of Status of TIMPs in Tomato Value Chain

The inventory process resulted in a total of 41 TIMPs that are ready for up-scaling, 52 TIMPs that require validation and 8 TIMPs that require further research in the sub-themes, as indicated in Table 2.

**Table 2. Number of TIMPs ready for up-scaling, require validation or further research**

Commodity/VC	Sub-Theme	Ready for up-scaling	Require validation	Further Research
Tomato	Improved varieties	0	12	0
Tomato	Seed systems	1	1	0
Tomato	Agronomic practices	1	3	0
Tomato	Natural resource management	1	9	0
Tomato	Physiological Disorders	0	2	0
Tomato	Pests and Diseases	10	9	6
Tomato	Weeds	2	4	2
Tomato	Food safety and GAP	2	0	0
Tomato	Postharvest Management	6	3	0
Tomato	Value addition	6	0	0
Tomato	Mechanization	10	1	0
Tomato	Business and Marketing	0	0	8
Tomato	Policy	0	0	4
<b>Overall Total</b>		<b>41</b>	<b>51</b>	<b>8</b>

**Table3: Inventory of Tomato TIMPs by Category and Status (Still working on this)**

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
<b>2.1 Improved varieties</b>	<b>Tomato varieties for open field</b>		
	2.1.1 Rio Grande	Technology	Requires validation
	2.1.2 Cal J	Technology	Requires validation
	2.1.3 Onyx	Technology	Requires validation
	2.1.4 Roma F1	Technology	Requires validation
	2.1.5 Kilele F1	Technology	Requires validation
	2.1.6 Raja F1	Technology	Requires validation
	2.1.7 Improved TKA lines	Technology	Requires validation
	<b>Tomato varieties for Greenhouse cultivation</b>		
	2.1.8 Anna F1	Technology	Requires validation
	2.1.9 Tylka F1,	Technology	Requires validation
	2.1.10 Chonto F1	Technology	Requires validation
	2.1.11 Bravo F1)	Technology	Requires validation
<b>Cherry tomato varieties</b>			

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
	2.1.12 Koko (JKUAT)	Technology	Requires validation
	2.1.13 Chika (JKUAT)	Technology	Requires validation
<b>2.2 Seed systems</b>	2.2.1 Raising clean Tomato seedlings in Nursery beds	Management practice	Ready for up-scaling
	2.2.2 Raising clean tomato seedlings in a greenhouse	Management practice	Ready for up-scaling
<b>2.3 Agronomic practices</b>	<b>Open field tomato cultivation</b>		
	2.3.1 Recommended spacing in open field	Management Practice	Ready for up-scaling
	2.3.2 Staking and pruning in open field	Management practice	Ready for up-scaling
	<b>Greenhouse Tomato cultivation</b>		
	2.3.3 Improved greenhouses for production of high quality tomatoes (JKUAT)	Technology	Validation
	2.3.4 Coco-peat based intensive tomato production (JKUAT)	Technology	Validation
<b>2.4 Natural Resource Management</b>	2.4.1 Rapid soil testing services	Innovation	
	2.4.2 Integrated Soil Fertility Management (ISFM)	Management Practice	
	2.4.3 Low cost composting technology	Technology	
	2.4.4 Integrated Manure Mangement (IMM)	Management Practice	
	2.4.5 Rain water roof water catchment	Management Practice	
	2.4.6 Mulching for weed management and moisture retention	Technology	
	2.4.7 Solar irrigation systems for smallholder farmers	Innovation	
	2.4.8 Drip irrigation	Management Practice	
	2.4.9 Styrofoam based intensive tomato production (JKUAT)	Technology	Validation
	2.4.10 Capillary wick-based irrigation system (JKUAT)	Technology	Validation
<b>2.5 Management of Physiological Disorders</b>	2.5.1 Management of blossom end rot	Management Practice	Ready for up-scaling
	2.5.2 Shade-net tomato cultivation for management of sunscald	Technology	Ready for up-scaling
	2.6.1 Scouting for pests identification and control	Management Practice	Ready for up-scaling

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
2.6 Pests and Diseases	2.6.2 Integrated Pest Management control practices	Management Practice	Validation
	2.6.3 Management of soil pests (Cut worms, <i>Agrotis</i> spp and Chafer grubs, <i>Melolontha</i> spp) by use of integrated control practices	Management Practice	Ready for up-scaling
	2.6.4 Management of white flies by use of integrated control practices	Management Practice	Ready for up-scaling
	2.6.5 Management of African bollworm, <i>Helicoverpa armigera</i> Hb by use of integrated control practices	Management Practice	Ready for up-scaling
	2.6.6 Management of red spider mites, <i>Tetranychus</i> spp. by use of integrated control practices.	Management Practice	Ready for up-scaling
	2.6.7 Management of tomato leaf miners ( <i>Tuta absoluta</i> and <i>Liriomyza</i> spp) by use of integrated control practices	Management Practice	Ready for up-scaling
	2.6.8 Management of Thrips ( <i>Thrips tabaci</i> , <i>Frankliniella occidentalis</i> , <i>F. schultzeii</i> and <i>Ceratothripoides brunneus</i> ) by use of integrated control practices	Management Practice	Ready for up-scaling
	2.6.9 Evaluation of pesticides for effectiveness in control of economic important pests for tomato	Management Practices	Ready for up-scaling
	2.6.10 Pesticides for management of insect pests	Management Practices	Ready for up-scaling
	2.6.11 Safe use of pesticides	Management Practices	Ready for up-scaling
	2.6.13 Use of plant extracts for control of tomato pests	Innovation	Requires further research
	2.6.14 Soil Solarization	Technology	Ready for up-scaling
	2.6.15 Crop rotation as a means of controlling diseases in tomatoes	Management Practice	Validation
2.6.16 Field sanitation as a means of controlling disease incidences	Management Practice	Ready for up-scaling	


<b>TIMPs Sub-Theme</b>	<b>TIMPs Title</b>	<b>TIMPs Category</b>	<b>Status</b>
	2.6.17 Evaluation of fungicides for effectiveness in control of economic important diseases for tomato	Management Practice	Requires further research
	2.6.18 Tomato Grafting	Innovation	Requires validation
	2.6.19 Disease resistant varieties	Technology	Requires validation
	2.6.20 Bio-control	Technology	Requires validation
	2.6.21 Trap crops	Technology	Requires validation
	2.6.22 Seed dressing for early pest management	Management practice	Requires validation
	2.6.23 Quarantine and movement restriction for management of pest and diseases	Management Practice	Ready for up-scaling
<b>2.7 Weeds</b>	2.7.1 Integrated Weed Management for Tomatoes	Management Practice	
	2.7.2 Cultural methods for weed control	Management Practice	
	2.7.3 Use of cover crops for weed management	Technology	
	2.7.4 Biodegradable mulching material	Technology	
	2.7.5 Biological control	Innovation	
	2.7.6 Tomato varieties resistant to parasitic weeds	Technology	
	2.7.7 APDC Approach	Innovation	
	2.7.8 Use of herbicides	Technology	
	2.7.9 Safe use of herbicides	Management practice	
<b>2.8 Good Agricultural Practices and Food Safety Management System</b>	2.8.1 Good Agricultural Practices	Management practice	Ready for up-scaling
	2.8.2 Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for Tomato Value Chain in Kenya	Management practice	Ready for up-scaling
<b>2.9 Harvest and Postharvest Management</b>	2.9.1 Maturity indices	Management Practice	Ready for up-scaling
	2.9.2 Harvesting Procedure	Management Practice	Ready for up-scaling
	2.9.3 Sorting and grading	Management Practice	Ready for up-scaling
	2.9.4 Evaporative charcoal cooler for tomato storage	Technology	Ready for up-scaling

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
	2.9.5 Zero-energy cooling unit for tomato storage	Technology	Ready for up-scaling
	2.9.6 Modified atmospheric packaging to extend shelf-life	Technology	Ready for up-scaling
	2.9.7 CoolBot™	Technology	Technology
	2.9.8 Wakati™	Technology	Technology
	2.9.9 Improved packaging for Cherry tomatoes JKUAT	Management Practice	Validation
<b>2.10 Value Addition</b>	2.10.1 Processing of tomato into pulp	Technology	Ready for up-scaling
	2.10.2 Dehydrated tomato	Technology	Ready for up-scaling
	2.10.3 Tomato jam	Technology	Ready for up-scaling
	2.10.4 Tomato juice	Technology	Ready for up-scaling
	2.10.5 Tomato sauce and ketchup	Technology	Ready for up-scaling
<b>2.11 Mechanization of Tomato Production Activities</b>	2.11.1 Power tiller	Technology	Ready for up-scaling
	2.11.2 Wheeler tractor less than 50HP	Technology	Ready for up-scaling
	2.11.3 Meld board plough	Technology	Ready for up-scaling
	2.11.4 Disc harrow	Technology	Ready for up-scaling
	2.11.5 Multifunction seedbed ridging machine	Technology	Ready for up-scaling
	2.11.6 Tomato direct planter	Technology	Ready for up-scaling
	2.11.7 Seedling tray planter	Technology	Ready for up-scaling
	2.11.8 Tomato transplanter	Technology	Ready for up-scaling
	2.11.9 Motorized sprayer	Technology	Ready for up-scaling
	2.11.10 Harvester	Technology	Ready for up-scaling
	2.11.11 Grading	Technology	Ready for up-scaling
<b>2.12 Business and marketing</b>	2.12.1 Transformative graduation model of tomato production	Mangement practice	Ready for up-scaling
	2.12.2 Building of business plan for tomato production	Mangement practice	Ready for up-scaling
	2.12.3 Collective marketing	Mangement practice	Ready for up-scaling
	2.12.4 Profitability analysis	Mangement practice	Ready for up-scaling
	2.12.5 Market research for market information	Mangement practice	Ready for up-scaling
	2.12.6 Contracted tomato production system	Mangement practice	Ready for up-scaling
	2.12.7 Marketing innovation model	Mangement practice	Ready for up-scaling
	2.12.8 Digital marketing	Mangement practice	Ready for up-scaling

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
<b>2.13 Agricultural Policy Options</b>	2.13.1 Framing tomato production in the National Agricultural Policy	Mangement practice	Ready for up-scaling
	2.13.2 Participation in County Integrated Development Planning	Mangement practice	Ready for up-scaling
	2.13.3 Policy instruments related to tomato value chain	Mangement practice	Ready for up-scaling
	2.13.4 Policy cycle	Mangement practice	Ready for up-scaling

## 2.0 DETAILED TOMATO VALUE CHAIN TIMPS

### 2.1 Varieties

<b>2.1.1 TIMP Name</b>	<b>Rio-Grande</b>
Category	Technology
<b>A: Description of the technology, innovation, or management practice</b>	
Problem addressed	Low productivity as a result of the prevalence of inferior seeds from (recycling seed) adapted to local conditions, verticillium and fusarium wilt.
What is it? (TIMP description)	<p>Rio-Grande is a medium-yielding variety with a potential of 84t/ha. It is a popular tomato variety suitable for all irrigated open-field cultivation regions. It has a determinate growth habit, matures in 75-80 days after transplanting, produces fruits weighing 74 gm on average. It performs best for all tomato-growing areas such as Mwea in Kirinyaga County, Ngurumani in Kajiado County and parts of Rift Valley and Western regions. It is also tolerant to verticillium and fusarium wilt. Rio-grande is also known to make soup.</p>  <p>Rio-Grande</p>
Justification	Cultivation of poorly adapted varieties leads to low production. Using improved varieties like Rio Grande improves productivity. Rio-grande offers high yields per unit area. It is also more palatable and preferred as a soup-making variety with longer shelf life.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	


Users of TIMP	Farmers, Extension agents, Traders, Processors, and agrochemical companies.
Approaches used in the dissemination.	Stakeholder training, field demonstrations, ASK shows, field days, farmer field schools, farmer research networks, farmer to farmer learning, mass media – agricultural programs, agricultural innovation platforms, print media brochures, conferences and journals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Adequate funds allocation for promotion activities.</li> <li>• Farmer, consumer, market and processing preference</li> <li>• .</li> <li>• Successful validation of technologies</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and market tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all year-round markets to motivate farmers.</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for a variety</li> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	- The variety was promoted in Kirinyaga County and has been widely adopted across other major tomato-growing areas such as Kajiado County
Counties where TIMPS should be up-scaled	- Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>- The variety has not been evaluated for tolerance to heat stress which is a constraint in the new target areas</li> <li>- Regional preference for a particular variety.</li> <li>- Negative perception that farmers have on new varieties based on the history seed companies and pirated germplasms.</li> <li>- Expectations from farmers that KALRO would finance all the season activities, and distribute free seed all seasons because is it the government.</li> <li>- It is not tolerant to emerging pests e.g. <i>Tuta absoluta</i></li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>- It is necessary to evaluate variety for heat stress tolerance and acceptable characteristics in target areas</li> <li>- Conduct field days with comparison to preferred varieties to change the farmers view.</li> <li>- Work with partners to curb dissemination of false information, and ensure that all marketed seed is certified.</li> <li>- Explain to the farmers the key implementation points of the project.</li> </ul>

	- Find alternative ways of handling <i>Tuta absoluta</i>
Lessons learnt in up-scaling if any	- Previous works have identified that farmer participatory approach works - Rio-grande is well adapted to all climatic conditions.
Social, environmental, policy and market conditions necessary for up-scaling	- Acceptability by the consumers. - Willingness of stakeholders to participate - Favorable climatic/ecological conditions - Regulatory bodies like KEPHIS to ensure consistent flow of certified seed. - Farm input costs are within the reach of farmers - Organized marketing channels are critical for benefits to be derived from technology
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	- KES 62,000/acre (Total variable costs include cost of seed); - Seed cost: KES 24,000/acre
Estimated returns	- KES 220,000/acre Gross margin
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Planting and weeding tomato are labour intensive, which are mostly done by women and youth</li> <li>• Women may be disadvantaged through lack of access to land to engage in tomato cultivation</li> <li>• High cost of seed and other inputs where small-scale farmers lack funds to acquire</li> <li>• Slow information and awareness flow to female farmers due to low academic levels of women.</li> <li>• Women may not have time to attend dissemination meetings due to their domestic roles</li> <li>• Low bargaining power for their tomato produce because it is sold at farm gate price</li> <li>• Women and youth have limited access to markets</li> </ul>
Gender-related opportunities	<ul style="list-style-type: none"> <li>• Opportunities for employment for women and youth employment at various nodes of the value chain</li> <li>• Target women and youth groups during FFBS for effective training of farmers on tomato production</li> <li>• Increase in yield increases youth involvement in sales and marketing, women involvement in sorting and grading.</li> <li>• Adoption of the TIMP has the potential of offering food and nutrition security to household members due to higher yields</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Laborious tomato production practices due to limited mechanization not favorable for VMGs</li> <li>• Dissemination methods and documents that are not always easy to understand or access by VMGs</li> <li>• VMGs have limited finances to buy inputs especially the expensive seed.</li> </ul>
VMG related opportunities	- Tomato is nutritious and has antioxidant properties which would be beneficial especially to health-challenged groups if engaged in growing and use

	- It is a lucrative enterprise and if involved VMGs will be availed opportunity to be gainfully engaged
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	- Baseline study conducted in Kajiado County under KOPIA Vegetable Project in 2018, indicated that the Rio-Grande variety was among the main tomato varieties grown by 22% of the farmers in an open field under irrigation.
Application guidelines for users	Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
<b>F: Status of TIMP</b>	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>
Lead organization and scientists	Kenya Seed Company, KALRO, A. Ndegwa, Rebecca Faraay
Partner organizations	JICA, Royal Seed Co Ltd.; Simlaw Seed Co. Ltd; MoALF&C

#### Research gaps

1. Evaluation of existing tomato varieties and new introductions for adaptability (e.g. tolerance to heat stress) in target zones
2. Establishment of a database of tomato cultivars in the market.

<b>2.1.2 TIMP Name</b>	<b>Cal-J</b>
Category	Technology
<b>A: Description of the technology, innovation, or management practice</b>	
Problem addressed	Low productivity associated with inferior seeds that are poorly adapted to extremes of dry and wet conditions.
What is it? (TIMP description)	Cal J is a popular open-pollinated, moderate yielding variety with a potential of 70t/ha. It exhibits resilience in wet and dry climates. It is determinate in growth habit, does not require staking, and matures in 70-75 days. Fruits weigh 68g on average, are deep red, blocky oval to round in shape and firm with a shelf life of up to 21 days when harvested at the breaker stage. It is also preferred in the processing industry.
	
	Cal J

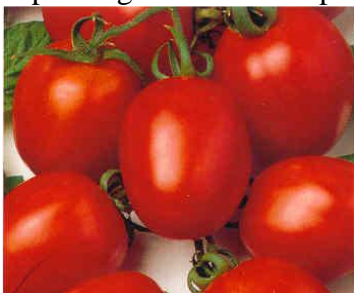
Justification	As a moderate yielder (70t/ha), with resilience to both wet and dry climates, Cal J offers a solution to farmers in areas with unreliable and unpredictable rainfall. It also processing industries value for money based on its shelf life and market preference.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension agents, Traders, Processors, and agrochemical companies.
Approaches used in the dissemination	Stakeholder training, field demonstrations, ASK shows, field days, farmer field schools, farmer research networks, farmer to farmer learning, mass media – agricultural programs, agricultural innovation platforms, print media brochures, conferences and journals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Adequate funds allocation for promotion activities.</li> <li>• Farmer, consumer, market, and processing preference</li> <li>• Successful validation of technologies</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and market tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all year-round markets to motivate farmers.</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for variety</li> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	- The variety was promoted in Kirinyaga County and has been widely adopted across other major tomato growing areas such as Kajiado County
Counties where TIMPS should be up-scaled	- Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>- Regional preference to a particular variety.</li> <li>- Negative perception that farmers have on new varieties based on the history seed companies and pirated germplasms.</li> <li>- Expectations from farmers that KALRO would finance all the season activities, and distribute free seed all seasons because is it the government.</li> <li>- The variety has not been evaluated for tolerance to heat stress which is a constraint in the new target areas</li> <li>- It is not tolerant to emerging pests e.g. <i>Tuta absoluta</i></li> </ul>
Suggestions for addressing the challenges	- It is necessary to evaluate variety for heat stress tolerance and acceptable characteristics in target areas

	<ul style="list-style-type: none"> <li>- Conduct field days with comparison to preferred varieties to change the farmers view.</li> <li>- Work with partners to curb dissemination of false information, and ensure that all marketed seed is certified.</li> <li>- Explain to the farmers the key implementation points of the project.</li> <li>- Find alternative ways of handling <i>Tuta absoluta</i></li> </ul>
Lessons learnt	<ul style="list-style-type: none"> <li>- Cal J is an old variety suitable for all climatic and agricultural zones in Kenya.</li> </ul>
Social, environmental, policy, and market conditions necessary for up-scaling	<ul style="list-style-type: none"> <li>- Acceptability by the consumers.</li> <li>- Willingness of stakeholders to participate</li> <li>- Favorable climatic/ecological conditions</li> <li>- Regulatory bodies like KEPHIS to ensure consistent flow of certified seed.</li> <li>- Farm input costs are within the reach of farmers</li> <li>- Organized marketing channels are critical for benefits to be derived from technology</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<ul style="list-style-type: none"> <li>- KES 58,000/acre (Total variable costs) Seed cost: KES 18,000</li> </ul>
Estimated returns	<ul style="list-style-type: none"> <li>- KES 220,000/acre gross margin</li> </ul>
Gender issues and concerns in development dissemination, adoption and scaling-up	<ul style="list-style-type: none"> <li>• Planting and weeding tomato are labour intensive, which are mostly done by women and youth</li> <li>• Women may be disadvantaged through lack of access to land to engage in tomato cultivation</li> <li>• High cost of seed and other inputs where small-scale farmers lack funds to acquire</li> <li>• Slow information and awareness flow to female farmers due to low academic levels of women</li> <li>• Women may not have time to attend dissemination meetings due to their domestic roles</li> <li>• Low bargaining power for their tomato produce because it is sold at farm gate price</li> <li>• Women and youth have limited access to markets</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Opportunities for employment for women and youth employment at various nodes of the value chain</li> <li>• Target women and youth groups during FFBS for effective training of farmers on tomato production</li> <li>• Increase in yield increases youth involvement in sales and marketing, women involvement in sorting and grading.</li> <li>• Adoption of the TIMP has the potential of offering food and nutrition security to household members due to higher yields</li> </ul>
VMG issues and concerns in development dissemination, adoption and scaling-up	<ul style="list-style-type: none"> <li>- Laborious tomato production practices due to limited mechanization not favourable for VMGs</li> <li>- Dissemination methods and documents that are not always easy to understand or access by VMGs</li> <li>- VMGs have limited finances to buy inputs especially the expensive seed</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>- Tomato is nutritious and has antioxidant properties which would be beneficial especially to health-challenged groups if</li> </ul>

	<p>engaged in growing and use</p> <ul style="list-style-type: none"> <li>- It is a lucrative enterprise and if involved VMGs will be availed opportunity to be gainfully engaged</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	- Baseline study conducted in Kajiado County under KOPIA Vegetable Project in 2018, indicated that Cal J variety was among the main tomato varieties grown by 53% of the farmers in open field under irrigation.
Application guidelines for users	Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
<b>F: Status of TIMP</b>	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>
Lead organization and scientists	Kenya Seed Company, KALRO, A. Ndegwa, Rebecca Faraay
Partner organizations	Royal Seed Co Ltd.; Simlaw Seed Co. Ltd.; MoALF&C

### Research gap

1. Evaluation of existing tomato varieties and new introductions for adaptability (e.g. Tolerance to heat stress) in target zones.
2. Establishment of a database of tomato cultivars in the market.

<b>2.1.3 TIMP Name</b>	<b>Onyx F1</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Loss of produce due to short shelf life of the fruits.
What is it? (TIMP description)	<p>Onyx F1 is a hybrid tomato variety with a long shelf life of 25 days, 4 days above the average 21 days. It has firm fruits making its transportation and handling easier. It is determinate in growth habit and does not require. It matures in 70 days from transplanting, has an average fruit weight of 105 gm and a yield potential of 45 t/ha depending on level of crop management.</p>  <p>Onyx F1</p>

Justification	Onyx F1 longer shelf life is an ideal attribute across the tomato value chain by reducing post-harvest losses. It saves the farmers, traders and consumers of food loss.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers Extension Service Providers, County Government, Farmer Groups/CBOs and NGOs Traders, Processors
Approaches used in the dissemination	Stakeholder training, field demonstrations, ASK shows, field days, farmer field schools, farmer research networks, farmer to farmer learning, mass media – agricultural programs, agricultural innovation platforms, print media brochures, conferences and journals
Most effective approach	Farmer participatory demonstrations/farmer field schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Adequate funds allocation for promotion activities.</li> <li>• Farmer, consumer, market and processing preference</li> </ul>
Partners/stakeholders for scaling up and roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and market tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all-year-round markets to motivate farmers.</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for variety</li> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	- The variety was promoted in Kirinyaga County and has been widely adopted across other major tomato-growing areas e.g. Kajiado County
Counties where TIMPS should be up-scaled	- Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Regional preference to a particular variety.</li> <li>• Negative perception that farmers have on new varieties based on the history seed companies and pirated germplasms.</li> <li>• Expectations from farmers that KALRO would finance all the season activities, and distribute free seed all seasons because is it the government.</li> </ul>


	<ul style="list-style-type: none"> <li>• The variety has not been evaluated for tolerance to heat stress which is a constraint in the new target areas</li> <li>• It is not tolerant to emerging pests e.g. <i>Tuta absoluta</i></li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• It is necessary to evaluate variety for heat stress tolerance and acceptable characteristics in target areas</li> <li>• Conduct field days with comparison to preferred varieties to change the farmers view.</li> <li>• Work with partners to curb dissemination of false information, and ensure that all marketed seed is certified.</li> <li>• Explain to the farmers the key implementation points of the project.</li> <li>• Find alternative ways of handling <i>Tuta absoluta</i></li> </ul>
Lessons learnt in up-scaling if any	<ul style="list-style-type: none"> <li>• Previous research indicates that the farmer participatory varietal evaluation approach works and enhances the adoption</li> </ul>
Social, environmental, policy and market conditions necessary for up-scaling	<ul style="list-style-type: none"> <li>- Acceptability by the consumers.</li> <li>- Willingness of stakeholders to participate</li> <li>- Favorable climatic/ecological conditions</li> <li>- Regulatory bodies like KEPHIS to ensure consistent flow of certified seed.</li> <li>- Farm input costs are within the reach of farmers</li> <li>- Organized marketing channels are critical for benefits to be derived from technology</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 80,000/acre (Total variable costs); seed cost KES 32000/-
Estimated returns	KES 310,000/acre gross margin
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Planting and weeding tomato are labour intensive, which are mostly done by women and youth</li> <li>• Women may be disadvantaged through lack of access to land to engage in tomato cultivation</li> <li>• High cost of seed and other inputs where small-scale farmers lack funds to acquire</li> <li>• Slow information and awareness flow to female farmers due to low academic levels of women</li> <li>• Women may not have time to attend dissemination meetings due to their domestic roles</li> <li>• Low bargaining power for their tomato produce because it is sold at farm gate price</li> <li>• Women and youth have limited access to markets</li> </ul>
Gender-related opportunities	<ul style="list-style-type: none"> <li>- Opportunities for employment for women and youth employment at various nodes of the value chain</li> <li>- Target women and youth groups during FFBS for effective training of farmers on tomato production</li> <li>- Increase in yield increases youth involvement in sales and marketing, women involvement in sorting</li> </ul>

	<p>and grading.</p> <ul style="list-style-type: none"> <li>- Adoption of the TIMP has the potential of offering food and nutrition security to household members due to higher yields</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Laborious tomato production practices due to limited mechanization not favourable for VMGs</li> <li>- Dissemination methods and documents that are not always easy to understand or access by VMGs</li> <li>- VMGs have limited finances to buy inputs especially the expensive seed</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>- Tomato is nutritious and has antioxidant properties which would be beneficial especially to health-challenged groups if engaged in growing and use</li> <li>- It is a lucrative enterprise and if involved VMGs will be availed opportunity to be gainfully engaged</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Baseline study conducted in Kajiado County under KOPIA Vegetable Project in 2018, indicated that Onyx variety was among the main tomato varieties grown by 31% of the farmers in an open field under irrigation.
Application guidelines for users	<ol style="list-style-type: none"> <li>1. KEPHIS Tomato cultivation manual and brochure with descriptor of this variety documented</li> <li>2. Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.</li> </ol>
<b>F: Status of TIMP</b>	Requires validation
<b>G: Contacts</b>	
Contacts	<p>Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a></p>
Lead organization and scientists	Royal Seed Co, KALRO- A. Ndegwa; Rebecca Faraay
Partner organizations	Simlaw Seeds Co. Ltd; MoALF&C

### Research gap

1. Evaluation of existing tomato varieties and new introductions for adaptability (e.g. tolerance to heat stress) in target zones
2. Establishment of a database of tomato cultivars in the market

<b>2.1.4 TIMP Name</b>	<b>Roma VF</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation, or management practice</b>	


Problem addressed	Low production of processing varieties in Kenya.
What is it? (TIMP description)	<p>Roma VF is an improved open-pollinated determinate tomato variety suitable processing purposes, for canning and making of Tomato paste. It is an open field determinate variety that does not require staking and matures in 80-85 days, with a yield potential of 83 t/ha. Fruits are deep red in color, pear-shaped and firm with few seeds, thick walls and dense flesh weighing 60g on average. The variety has a high demand by the canning industry for making tomato sauce and paste and is also among the best varieties for drying.</p>  <p>Roma VF</p>
Justification	Roma VF characteristics preferred for processing makes the variety to stand out in the local production reducing the cost and need for importation of tomato paste for processing purposes.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	- Farmers, extension service providers, County Government, Farmer groups/CBOs and NGOs, processing industries, traders,
Approaches used in the dissemination	Stakeholder training, field demonstrations, ASK shows, field days, farmer field schools, farmer research networks, farmer to farmer learning, mass media – agricultural programs, agricultural innovation platforms, print media brochures, conferences and journals
Most effective approach	- Farmer participatory demonstrations and farmer field schools have been found effective in previous projects
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Adequate funds allocation for promotion activities.</li> <li>• Farmer, consumer, market and processing preference</li> </ul>
Partners/stakeholders for scaling up and roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and market tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all-year-round markets to motivate farmers.</li> </ul>

	<ul style="list-style-type: none"> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for a variety.</li> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	- The variety is grown in some tomato production areas such as the Coastal zone targeting the processing market
Counties where TIMPS should be up-scaled	- Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>- Regional preference to a particular variety.</li> <li>- Negative perception that farmers have on new varieties based on the history seed companies and pirated germplasms.</li> <li>- Expectations from farmers that KALRO would finance all the season activities, and distribute free seed all seasons because is it the government.</li> <li>- The variety has not been evaluated for tolerance to heat stress which is a constraint in the new target areas</li> <li>- It is not tolerant to emerging pests e.g. <i>Tuta absoluta</i></li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>- There is need to need to evaluate the variety for adaptability in new target areas with particular focus on heat stress tolerance and acceptable fruit characteristics</li> <li>- Conduct field days with comparison to preferred varieties to change the farmers view.</li> <li>- Work with partners to curb dissemination of false information, and ensure that all marketed seed is certified.</li> <li>- Explain to the farmers the key implementation points of the project.</li> </ul>
Lessons learnt	- Farmer participatory approach worked well in previous projects
Social, environmental, policy and market conditions necessary for development	<ul style="list-style-type: none"> <li>- Acceptability by the consumers.</li> <li>- Willingness of stakeholders to participate</li> <li>- Favorable climatic/ecological conditions</li> <li>- Regulatory bodies like KEPHIS to ensure consistent flow of certified seed.</li> <li>- Farm input costs are within the reach of farmers</li> <li>- Organized marketing channels are critical for benefits to be derived from technology</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 90,000/acre (variable costs) seed cost: KES 28000
Estimated returns	KES 300,000/acre gross margin
Gender issues and concerns in development dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Planting and weeding tomato are labour intensive, which are mostly done by women and youth</li> <li>- Women may be disadvantaged through lack of access to land to engage in tomato cultivation</li> <li>- High cost of seed and other inputs where small-scale farmers lack funds to acquire</li> <li>- Slow information and awareness flow to female farmers due to low academic levels of women</li> </ul>

	<ul style="list-style-type: none"> <li>- Women may not have time to attend dissemination meetings due to their domestic roles</li> <li>- Low bargaining power for their tomato produce because it is sold at farm gate price</li> <li>- Women and youth have limited access to markets</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>- Opportunities for employment for women and youth employment at various nodes of the value chain</li> <li>- Target women and youth groups during FFBS for effective training of farmers on tomato production</li> <li>- Increase in yield increases youth involvement in sales and marketing, women involvement in sorting and grading.</li> <li>- Adoption of the TIMP has the potential of offering food and nutrition security to household members due to higher yields</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Laborious tomato production practices due to limited mechanization not favourable for VMGs</li> <li>- Dissemination methods and documents that are not always easy to understand or access by VMGs</li> <li>- VMGs have limited finances to buy inputs especially the expensive seed</li> </ul>
VMG issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> <li>- Lack of access to land and credit for tomato production may hinder VMGs from taking up growing of the variety</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• The VMGs can easily grow the variety and further engage in cottage-level processing to various products that have a longer shelf life</li> <li>• This will ensure continuous availability of nutritious tomato products with antioxidant properties which would be beneficial especially to health-challenged groups if engaged in growing and use</li> <li>• Cultivation of a tomato variety like Roma VF with processing potential is a lucrative enterprise and if involved, VMGs will be availed opportunity to be gainfully engaged</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	
Application guidelines for users	Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
<b>F: Status of TIMP</b>	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>
Lead organization and scientists	KALRO: A. Ndegwa, Rebecca Faraay, Rahab Magoti, Charity Gathambiri, Finyange Pole,
Partner organizations	Royal Seed Co Ltd.; Simlaw Seeds Co. Ltd.; MoALF&C

### Research gap

1. Evaluation of existing tomato varieties and new introductions for adaptability (e.g. tolerance to heat stress) in target zones
2. Establishment of a database of tomato cultivars in the market

<b>2.1.5 TIMP Name</b>	<b>Kilele F1</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low productivity as a result of attack by Tomato yellow leaf curl virus, Tomato mosaic virus, Nematodes, verticillium and Fusarium wilt.
What is it? (TIMP description)	<p>Kilele F1 is an improved hybrid tomato variety that has tolerance to Tomato Yellow leaf curl virus, tomato mosaic virus, nematodes, verticillium and fusarium wilt. It has a semi-determinate growth habit, very firm and elongated fruits with longer harvesting periods of up to 10 weeks and a shelf life.</p>  <p>Kilele F1</p>
Justification	Kilele F1 has tolerance to tomato yellow leaf curl virus, tomato mosaic virus, nematodes, verticillium and fusarium wilt making it adaptable to regions or soils with these problems.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers Extension Service Providers, County Government, Farmer Groups/CBOs and NGOs Traders, Processors
Approaches used in the dissemination	<ul style="list-style-type: none"> <li>• Stakeholder training</li> <li>• Field demonstrations</li> <li>• ASK shows</li> <li>• Field days</li> <li>• Farmer field schools</li> <li>• Radio/TV broadcasts</li> <li>• Farmer research networks</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programs</li> <li>• Agricultural innovation platforms</li> </ul>

	<ul style="list-style-type: none"> <li>• Print media brochures</li> <li>• Conferences and journals</li> </ul>
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Adequate funds allocation for promotion activities.</li> <li>• Farmer, consumer, market and processing preference</li> </ul>
Partners/stakeholders for scaling up and roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and market tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all year-round markets to motivate farmers.</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for variety</li> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	- The variety has been adopted in some major tomato-growing areas such as Kirinyaga and Kajiado
Counties where TIMPS should be up-scaled	- Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>- Regional preference to a particular variety.</li> <li>- Negative perception that farmers have on new varieties based on the history seed companies and pirated germplasms.</li> <li>- Expectations from farmers that KALRO would finance all the season activities, and distribute free seed all seasons because is it the government.</li> <li>- The variety has not been evaluated for tolerance to heat stress which is a constraint in the new target areas</li> <li>- It is not tolerant to emerging pests e.g. <i>Tuta absoluta</i></li> </ul>
Suggestions for addressing the addressing the challenges	<ul style="list-style-type: none"> <li>- It is necessary to evaluate variety for heat stress tolerance and acceptable characteristics in target areas</li> <li>- Conduct field days with comparison to preferred varieties to change the farmers view.</li> <li>- Work with partners to curb dissemination of false information, and ensure that all marketed seed is certified.</li> <li>- Explain to the farmers the key implementation points of the project.</li> <li>- Find alternative ways of handling <i>Tuta absoluta</i></li> </ul>
Lessons learnt	- Farmer participatory approach has been found effective in previous related research activities

Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>- Acceptability by the consumers.</li> <li>- Willingness of stakeholders to participate</li> <li>- Favorable climatic/ecological conditions</li> <li>- Regulatory bodies like KEPHIS to ensure consistent flow of certified seed.</li> <li>- Farm input costs are within the reach of farmers</li> <li>- Organized marketing channels are critical for benefits to be derived from technology</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 250,000/acre (Total variable costs) Total seed cost KES 40,000/-
Estimated returns	KES 400,000/acre gross margin
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Planting and weeding tomato are labour intensive, which are mostly done by women and youth</li> <li>• Women may be disadvantaged through lack of access to land to engage in tomato cultivation</li> <li>• High cost of seed and other inputs where small-scale farmers lack funds to acquire</li> <li>• Slow information and awareness flow to female farmers due to low academic levels of women</li> <li>• Women may not have time to attend dissemination meetings due to their domestic roles</li> <li>• Low bargaining power for their tomato produce because it is sold at farm gate price</li> <li>- Women and youth have limited access to markets</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>- Opportunities for employment for women and youth employment at various nodes of the value chain</li> <li>- Target women and youth groups during FFBS for effective training of farmers on tomato production</li> <li>- Increase in yield increases youth involvement in sales and marketing, women involvement in sorting and grading.</li> <li>- Adoption of the TIMP has the potential of offering food and nutrition security to household members due to higher yields</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Laborious tomato production practices due to limited mechanization not favourable for VMGs</li> <li>- Dissemination methods and documents that are not always easy to understand or access by VMGs</li> <li>- VMGs have limited finances to buy inputs especially the expensive seed</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Laborious tomato production practices due to limited mechanization not favourable for VMGs</li> <li>• Dissemination methods and documents that are not always easy to understand or access by VMGs</li> <li>- VMGs have limited finances to buy inputs especially the expensive seed</li> </ul>
<b>E: Case studies/profiles of success stories</b>	

Success stories	- Baseline study conducted in Kajiado County under KOPIA Vegetable Project in 2018, indicated that Kilele F1 variety was among the main tomato varieties grown by 26% of the farmers in open field under irrigation.
Application guidelines for users	1. Tomato cultivation brochure with descriptor of this variety is documented 2. Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
<b>F: Status of TIMP</b>	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>
Lead organization and scientists	KALRO, A. Ndegwa; Rebecca Faraay, Rahab Magoti, Charity Gathambiri
Partner organizations	Sygenta Seed Co Ltd.; Simlaw Seeds Co. Ltd; MoALF&C

### Research gap

1. Evaluation of existing tomato varieties and new introductions for adaptability (e.g.tolerance to heat stress) in target zones
2. Establishment of a database of tomato cultivars in the market

<b>2.1.6 TIMP Name</b>	<b>Raja F1</b>
Category	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low productivity resulting from poor adaptation to heat and water stress.
What is it? (TIMP description)  Raja F1	Raja F1 is an improved hybrid tomato variety that is highly adapted to heat and water stress. It is also an extremely early maturing variety just 65 days. It is a medium Semi-determinate in growth habit, very firm, deep red, ovular and weigh between 120-150g. it has a long harvest period up-to 10 weeks and produces 30–35 tonnes per acre under good agronomic practice. It has a long shelf life up-to 21 days and Resistant to Tomato yellow leaf curl virus (TYLCV), Tomato Mosaic virus (TMV), Verticillium wilt, Fusarium wilt, Bacterial wilt and nematodes
Justification	The variety is resilient in heat and drought, going for an extra 4 days from the average 3 day of other varieties. It has firm fruit with long shelf life and good transportability as well as resistance to some of the major tomato diseases.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, processors


Approaches used in dissemination	Stakeholder training, field demonstrations, farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, Logistics (Transport)
Partners/stakeholders for scaling up and roles	County Government - to provide extension services and funding; Seed companies - to provide improved certified seeds and varieties; Individual farmers - to grow and market tomatoes; Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers - to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	- The variety has been adopted in some major tomato-growing areas such as Kajiado and Kajiado
Counties where TIMPS should be up-scaled	- Kirinyaga, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	- Regional preference for a particular variety. - Negative perception that farmers have on new varieties based on the history seed companies and pirated germplasms. - Expectations from farmers that KALRO would finance all the season activities, and distribute free seed all seasons because is it the government.
Suggestions for addressing the addressing the challenges	- Conduct field days with comparison to preferred varieties to change the farmers view. - Work with partners to curb dissemination of false information, and ensure that all marketed seed is certified. - Explain to the farmers the key implementation points of the project.
Lessons learnt	- Farmer participatory approach has been found effective in previous related research activities
Social, environmental, policy and market conditions necessary for development and upscaling	- Acceptability by the consumers. - Willingness of stakeholders to participate - Favorable climatic/ecological conditions - Regulatory bodies like KEPHIS to ensure consistent flow of certified seed. - Farm input costs are within the reach of farmers - Organized marketing channels are critical for benefits to be derived from technology
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 250,000/acre (Total variable costs) seed cost KES 50000
Estimated returns	KES 750,000/acre gross margin
Gender issues and concerns in development, dissemination, adoption and scaling up	- Planting and weeding tomato are labour intensive, which are mostly done by women and youth - Women may be disadvantaged through lack of access to land to engage in tomato cultivation


	<ul style="list-style-type: none"> <li>- High cost of seed and other inputs where small-scale farmers lack funds to acquire</li> <li>- Slow information and awareness flow to female farmers due to low academic levels of women</li> <li>- Women may not have time to attend dissemination meetings due to their domestic roles</li> <li>- Low bargaining power for their tomato produce because it is sold at farm gate price</li> <li>- Women and youth have limited access to markets</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>- Opportunities for employment for women and youth employment at various nodes of the value chain</li> <li>- Target women and youth groups during FFBS for effective training of farmers on tomato production</li> <li>- Increase in yield increases youth involvement in sales and marketing, women involvement in sorting and grading.</li> <li>- Adoption of the TIMP has the potential of offering food and nutrition security to household members due to higher yields</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Laborious tomato production practices due to limited mechanization not favourable for VMGs</li> <li>- Dissemination methods and documents that are not always easy to understand or access by VMGs</li> <li>- VMGs have limited finances to buy inputs especially the expensive seed</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>- Tomato variety Raja F1 has nutritious and antioxidant properties which would be beneficial especially to health challenged groups if engaged in growing and use</li> <li>- It is a lucrative enterprise and if involved VMGs will be availed opportunity to be gainfully engaged</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	<ul style="list-style-type: none"> <li>- Mama Mboga and Iparakauo SHG in Rombo, Kajiado use and prefer Raja F1 against other tomato Varieties.</li> <li>- Young star Farmers in Garissa is a beneficiary and switched to Raja F1 as their preferred variety.</li> <li>- Elgeiyo Marakwet county farmers prefer Raja F1 over other tomato varieties.</li> </ul>
Application guidelines for users	Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
<b>F: Status of TIMP</b>	2. Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>

Lead organization and scientists	KALRO, A. Ndegwa; Rebecca Faraay, Rahab Magoti, Charity Gathambiri
Partner organizations	Advanta ,Sygenta Seed Co Ltd.; Simlaw Seeds Co. Ltd; MoALF&C

### Research gap

1. Evaluation of existing tomato varieties and new introductions for adaptability (e.g. tolerance to heat stress) in target zones
2. Establishment of a database of tomato cultivars in the market


<b>2.1.7 TIMP name</b>	<b>Improved TKA lines</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Lack of tomato varieties tolerant to nematodes with acceptable fruit traits
What is it? (TIMP description)	<p>The six TKA lines are locally improved for tolerance to nematodes and fruit traits. The lines have the following characteristics:</p> <ul style="list-style-type: none"> <li>• 60-75 days to maturity (start of harvesting)</li> <li>• Determinate growth habit</li> <li>• Large elongated oval fruit with deep red skin colour</li> <li>• Tolerant to nematodes</li> <li>• Yield: 25-30 t/ha</li> </ul>  <p>TKA-Tomato lines</p>
Justification	The TKA lines were developed from popular commercial varieties and nematode resistant lines as parents. They are superior in terms of number of fruit per plant, fruit size, fruit firmness, and general appearance of the fruit (oval shape, uniform deep red colour, absence of green shoulders). During participatory evaluation of the lines in on-farm trials, majority of the farmers and traders considered the elongated oval fruit shape and firmness to be associated with a good variety. This is because a commercial variety Cal J that is widely popular has an elongated oval shape and firm skin that withstands transportation to long distant markets. Hence these lines

	<p>have good potential for acceptability in other target tomato production areas.</p> 
Region promoted	Limited in Kirinyaga County (Kibirigwi Irrigation Scheme)
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension service providers, traders, processors
Approaches to be used in dissemination	Newspaper, ASK shows, TV, farmer participatory multilocational trials
Most effective approach	Farmer participatory demonstrations/ farmer field business schools
Critical/essential factors for successful promotion	Validation through on farm trials with participation of farmers
Partners/stakeholders for scaling up and their roles	County Government - to provide extension services for collaboration, Seed companies - to collaborate in seed multiplication and provision, individual farmers- to grow and market tomatoes, Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers – to provide viable all year round markets at good prices that spur growth of the crop, KEPHIS for NPT
<b>C: Current situation and future scaling up</b>	
Current extent of reach	Limited
Counties where already promoted, if any	Kirinyaga
Counties where TIMP will be up-scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	Limited knowledge on performance of the lines in other locations
Suggestions for addressing the challenges	To undertake national performance trials and registration
Lessons learnt in up-scaling, if any	-
Social, environmental, policy and market conditions necessary for development and upscaling	Approval by KEPHIS required
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Not done (Variety is not yet commercial)
Estimated returns	Not done

Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Planting and weeding tomato are labour intensive, which are mostly done by women and youth</li> <li>• Women may be disadvantaged through lack of access to land to engage in tomato cultivation</li> <li>• High cost of seed and other inputs where small-scale farmers lack funds to acquire</li> <li>• Slow information and awareness flow to female farmers due to low academic levels of women</li> <li>• Women may not have time to attend dissemination meetings due to their domestic roles</li> <li>• Low bargaining power for their tomato produce because it is sold at farm gate price</li> </ul> <p>- Women and youth have limited access to markets</p>
Gender related opportunities	<p>- Opportunities for employment for women and youth employment at various nodes of the value chain</p> <p>- Target women and youth groups during FFBS for effective training of farmers on tomato production</p> <p>- Increase in yield increases youth involvement in sales and marketing, women involvement in sorting and grading.</p> <p>- Adoption of the TIMP has the potential of offering food and nutrition security to household members due to higher yields</p>
VMG issues and concerns in development, dissemination, adoption and scaling up	<p>- Laborious tomato production practices due to limited mechanization not favourable for VMGs</p> <p>- Dissemination methods and documents that are not always easy to understand or access by VMGs</p> <p>- VMGs have limited finances to buy inputs especially the expensive seed</p>
VMG related opportunities	<p>- Tomato is nutritious and has antioxidant properties which would be beneficial especially to health-challenged groups if engaged in growing and use</p> <p>- It is a lucrative enterprise and if involved VMGs will be availed opportunity to be gainfully engaged</p>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	
Application guidelines for users	Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
F: Status of TIMP readiness	<b>2.</b> Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>

Lead organization and scientists	KALRO: A. Ndegwa, Rebecca Faraay, Eliezer Kamau, Charity Gathambiri, George Madumadu-breeder(posthumous) James Mureithi, Samson Kihara
Partner organizations	MOA, KEPHIS

### Tomato varieties for Greenhouses

<b>2.1.8 TIMP Name</b>	<b>Anna F1</b>
Category	Technology
<b>A: Description of the technology, innovation or management practice</b>	
<b>Problem addressed</b>	Low productivity from poor choice of selection of greenhouse varieties
What is it? (TIMP description)	<p><b>Anna F1</b> is an introduced hybrid variety that performs very well in greenhouse with a yield potential of 185t/ha. It can also be planted in the open field. Fruits are deep-red, oval-shaped and firm, an early maturing variety at 75 days with a yield of 185t/ha. Its tolerant to Alternaria, stem canker, Verticillium , fusarium wilt and nematodes.</p>  <p>Anna F1</p>
Justification	Anna F1 has very high yield potential which guarantees return on investment for the high cost of input in greenhouse construction. A greenhouse is a high investment area that requires better performing varieties.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers Extension Service Providers, County Government, Farmer Groups/CBOs and NGOs Traders, Processors
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• Stakeholder training</li> <li>• Field demonstrations</li> <li>• ASK shows</li> <li>• Field days</li> <li>• Farmer field schools</li> <li>• Radio/TV broadcasts</li> <li>• Farmer research networks</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programs</li> </ul>


	<ul style="list-style-type: none"> <li>• Agricultural innovation platforms</li> <li>• Print media brochures</li> <li>• Conferences and journals</li> </ul>
Most effective approach	Farmer Participatory demonstrations, farmer field schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Adequate funds allocation for promotion activities.</li> <li>• Farmer, consumer, market and processing preference</li> </ul>
Partners/stakeholders for scaling up and roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and market tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all year-round markets to motivate farmers.</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for variety</li> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	- The variety is widely grown by greenhouse farmers in various regions/Counties such as Kiambu, Murang'a, Kajiado, Nairobi, Meru, Nyandarua, Machakos, Kitui, Trans-Nzoia, Nandi, Bungoma
Counties where TIMP will be up-scaled	- Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>- In-appropriate greenhouse structures</li> <li>- The variety is not tolerant to emerging pests e.g. <i>Tuta absoluta</i> and problematic diseases such as bacterial wilt</li> <li>- Telephone farming is rampant with many greenhouse farmers</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>- Appropriate greenhouse structures should be promoted to ensure that the optimum potential of recommended varieties for the cultivation system is achieved</li> <li>- Varieties with tolerance to the biotic and abiotic stresses need to be introduced and evaluated</li> <li>- The person managing the greenhouse should be the recipient of training on greenhouse farming</li> </ul>
Lessons learnt	<ul style="list-style-type: none"> <li>- Experiences gained while working with greenhouse tomato farmers indicate that:</li> <li>- Farmer participatory approach works where farmers practically gain hands-on experience in managing greenhouse crop</li> <li>- Greenhouse tomato cultivation requires expertise</li> <li>- Group-managed greenhouses have a high failure rate, so approach on individual farmer basis more sustainable</li> </ul>

Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>- Willingness of stakeholders to participate</li> <li>- Customizing greenhouses to the prevailing ecological conditions.</li> <li>- Organized marketing channels are critical for benefits to be derived from technology</li> <li>- Greenhouse crop cultivation requires appropriate regulatory frameworks</li> <li>- Farm input costs are within the reach of farmers</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 400,000 (8Million/acre)(including the cost of 8x30 greenhouse) seed cost KES 14300 (291000/acre)
Estimated returns	KES 720,000 (1st season) (15Million/acre)
Gender issues and concerns in development dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- The technology can be easily applied by all gender categories since the variety is suited for greenhouse production where activities are relatively easier to manage</li> <li>- Some gender categories (e.g. youth and women) may be disadvantaged by lack of access to land and capital to put up a greenhouse</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>- All gender categories can participate in growing tomato varieties in greenhouse</li> <li>- A lucrative commercial enterprise across the gender divide and for VMGs</li> <li>- It should be attractive especially to youth since it is smart farming</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Lack of access to credit for initial capital cost of putting up greenhouse is a concern for VMGs</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>- It is a lucrative enterprise and if involved, VMGs will be availed opportunity to be gainfully engaged</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Youth groups in Kiambu County and farmers in peri-urban Nairobi County are successfully growing this variety in greenhouses
Application guidelines for users	Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
<b>F: Status of TIMP</b>	2. Requires validation
<b>F: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>
Lead organization and scientists	KALRO, A. Ndegwa, Vincent Ochieng, Rahab Magoti, Finyange Pole

Partner organizations	JKUAT, Royal Seed Co Ltd; Simlaw Seeds Co. Ltd.; MoALF&C
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### Research gap

1. Evaluation of existing tomato varieties and new introductions for adaptability (e.g. tolerance to heat stress) in target zones
2. Establishment of a database of tomato cultivars in the market


<b>2.1.9 TIMP Name</b>	<b>Tylka F1</b>
Category	Technology
<b>A: Description of the technology, innovation or management practice</b>	
<b>Problem addressed</b>	Loss of produce caused by low shelf life of some tomato varieties
What is it? (TIMP description)	<p>Tylka F1 is a hybrid tomato variety with an exceptional long shelf life of up to 28 days. It is ideal for both greenhouse and outdoor cultivation. It has firm fruits, matures early after 75 days, with an elongated harvesting period of 4-6 months. High yield potential: 120t/240m<sup>2</sup> (8x30m greenhouse) and is resistant to Tomato leaf curl virus, Tomato mosaic virus and Grey spot</p>  <p>Tylka F1</p>
Justification	Tylka F1 solves the problem of short shelf life in greenhouse tomatoes. It can remain firm for up to 28 days after harvesting making it reduce post-harvest losses.
Region promoted	Kirinyaga (Mwea, Kagio), Kiambu Kajiado, Muranga, Nairobi, Trans Nzoia, Uasin Gishu, Kisumu
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers Extension Service Providers, County Government, Farmer Groups/CBOs and NGOs Traders, Processors
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• Stakeholder training</li> <li>• Field demonstrations</li> <li>• ASK shows</li> <li>• Field days</li> <li>• Farmer field schools</li> <li>• Radio/TV broadcasts</li> <li>• Farmer research networks</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programs</li> <li>• Agricultural innovation platforms</li> <li>• Print media brochures</li> <li>• Conferences and journals</li> </ul>
Most effective approach	Farmer Participatory demonstrations, farmer field schools

Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Adequate funds allocation for promotion activities.</li> <li>• Farmer, consumer, market and processing preference</li> </ul>
Partners/stakeholders for scaling up and roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and market tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all year-round markets to motivate farmers.</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for variety</li> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	- The variety has been adopted by farmers growing tomato in greenhouse in various Counties e.g. Kiambu, Murang'a, Kajiado, Nairobi, Machakos, Kitui, Trans-Nzoia, Bungoma
Counties where TIMP will be up-scaled	- Future scaling up: Siaya, Elgeyo-Marakwet, Garissa, Mandera, W. Pokot (if demanded)
Challenges in dissemination	<ul style="list-style-type: none"> <li>- In-appropriate greenhouse structures</li> <li>- Lack of access to credit for initial capital cost of putting up greenhouse is a concern</li> <li>- The variety is not tolerant to emerging pests e.g. <i>Tuta absoluta</i> and problematic diseases such as bacterial wilt</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>- Appropriate greenhouse structures should be promoted to ensure that the optimum potential of recommended varieties for the cultivation system is achieved</li> <li>- Varieties with tolerance to the biotic and abiotic stresses need to be introduced and evaluated</li> <li>- The person actually managing the greenhouse should be the recipient of training on greenhouse farming</li> </ul>
Lessons learnt	<ul style="list-style-type: none"> <li>- Previous experience indicates that Farmer participatory approach works</li> <li>- Greenhouse tomato cultivation requires expertise</li> <li>- Group managed greenhouses apparently have a high failure rate, so approach on individual farmer basis would be more feasible</li> </ul>
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>- Greenhouse crop cultivation requires appropriate regulatory frameworks</li> <li>- Organized marketing channels are critical for benefits to be derived from technology</li> <li>- Favorable environmental conditions</li> <li>- Willingness of stakeholders to participate</li> </ul>

	- Farm input costs are within the reach of farmers
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 400,000 (including capital cost of 8x30m greenhouse)
Estimated returns	KES 750,000 (1st season)
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- The technology can be easily applied by all gender categories since the variety is suited for greenhouse production where activities are relatively easier to manage</li> <li>- Lack of capital to set up greenhouse structure could be a concern</li> <li>- Some gender categories (youth and women) may be disadvantaged by lack of access to land and capital to put up a greenhouse</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>- All gender categories can participate in growing the tomato variety in greenhouse</li> <li>- Growing the tomato variety in greenhouse should be especially attractive to youth since it is smart farming with quick gains</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Lack of access to credit for initial capital cost of putting up greenhouse is a concern</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>- VMGs can easily undertake growing of the tomato variety in greenhouse if their concerns are addressed through affirmative action</li> <li>- It is a lucrative enterprise and if involved, VMGs will be availed opportunity to be gainfully engaged</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	- Youth groups in Kiambu County and farmers in peri-urban Nairobi County are successfully growing this variety in the greenhouse
Application guidelines for users	Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
<b>F: Status of TIMP</b>	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>
Lead organization and scientists	KALRO: A. Ndegwa, Rahab Magoti, Finyange Pole, Charity Gathambiri, Vincent Ochieng
Partner organizations	JKUAT, Royal Seed Co Ltd.; Simlaw Seeds Co. Ltd.; MoALF&C


### Research gap

3. Evaluation of existing tomato varieties and new introductions for adaptability (e.g. tolerance to heat stress) in target zones
4. Establishment of a database of tomato cultivars in the market

<b>2.1.10 TIMP Name</b>	<b>Chonto F1</b>
Category	Technology
<b>A: Description of the technology, innovation or management practice</b>	
<b>Problem addressed</b>	Low productivity resulting from lightweight of fruits.
What is it? (TIMP description)	<p><b>Chonto F1</b> is a hybrid premium tomato with a potential fruit weight of 150-200g per fruit. The variety is suited for greenhouse cultivation maturity of 75 days, long harvest period of up to 8 months and a yield potential of 300t/ha.</p>  <p>Chonto F1</p>
Justification	Chonto F1 has the potential of producing heavy fruit sets. This solves low productivity by increasing weight per unit area of production which translates to better return on investment (ROI)
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers Extension Service Providers, County Government, Farmer Groups/CBOs and NGOs Traders, Processors
Approaches used in dissemination	Stakeholder training, field demonstrations, ASK shows, field days Farmer field schools, farmer research networks farmer to farmer learning, Mass media – Agricultural programs Agricultural innovation platforms, print media brochures, conferences and journals
Most effective approach	Farmer Participatory demonstrations, farmer field schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Adequate funds allocation for promotion activities.</li> <li>• Farmer, consumer, market and processing preference</li> </ul>
Partners/stakeholders for scaling up and roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and market tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all year-round markets to motivate farmers.</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for variety</li> </ul>

	<ul style="list-style-type: none"> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	The variety has been adopted by farmers growing tomato in greenhouse in various Counties such as Kiambu, Murang'a, Kajiado, Nairobi, Machakos, Kitui, Trans-Nzoia, Bungoma
Counties where TIMP will be up-scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	-In-appropriate greenhouse structures -Variety not tolerant to emerging pests e.g. <i>Tuta absoluta</i> and problematic diseases such as bacterial wilt
Suggestions for addressing the challenges	-Need to introduce and evaluate heat stress and bacterial wilt tolerant varieties with acceptable characteristics for evaluation in target areas
Lessons learnt	-Farmer participatory approach works -Greenhouse tomato cultivation requires expertise -Group managed greenhouses apparently have a high failure rate, so approach on individual farmer basis more sustainable
Social, environmental, policy and market conditions necessary for development and up-scaling	-Organized marketing channels are critical for benefits to be derived from technology -Greenhouse crop cultivation requires appropriate regulatory frameworks
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 400,000 (including cost of 8x30m greenhouse)
Estimated returns	KES 750,000 (1st season)
Gender issues and concerns in development, dissemination, adoption and scaling up	- Some gender categories (e.g. youth and women) may be disadvantaged in adopting the variety due to lack of access to land and capital to put up a greenhouse
Gender related opportunities	- The variety can be easily applied by all gender categories if issues of concern are addressed since the variety is suited for greenhouse production where activities are relatively easier to manage than in open field; - It should be especially attractive to youth due to quick high returns expected
VMG issues and concerns in development, dissemination, adoption and scaling up	- Inclusivity of VMGs is critical in the process to avoid perpetuation of marginalization - Lack of access to credit for initial capital cost of putting up greenhouse is a concern
VMG related opportunities	- It is a lucrative enterprise and if involved, VMGs will be availed opportunity to be gainfully engaged
<b>E: Case studies/profiles of success stories</b>	
Success stories	-Youth groups in Kiambu and farmers in peri-urban Nairobi County are successfully growing this variety in greenhouse
Application guidelines for users	Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
<b>F: Status of TIMP</b>	Requires validation

<b>G: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>
Lead organization and scientists	KALRO: A. Ndegwa, Rahab Magoti, Finyange Pole, Charity Gathambiri, Vincent Ochieng
Partner organizations	JKUAT; Royal Seed Co Ltd.; Simlaw Seeds Co. Ltd.; MoALF&C

<b>2.1.11 TIMP Name</b>	<b>Bravo F1</b>
Category	Technology
<b>A: Description of the technology, innovation or management practice</b>	
<b>Problem addressed</b>	Poor productivity resulting from poor adaptability to different agroecological zones
What is it? (TIMP description)	<p><b>Bravo F1</b> is hybrid tomato variety that adapts well to a wide range of agroecological zones. It is indeterminate with longer harvest period, early maturing with a yield potential of 240t/ha. It is resistant/ tolerant to tomato Yellow Leaf Curl Virus (TYLCV), Fusarium Wilt, Verticillium Wilt, Grey Leaf Spot and Nematodes.</p>  <p>Bravo F1</p>
Justification	The variety has a wide adaptability and can therefore withstand diverse micro-climates in the greenhouse. It is high yielding, has acceptable fruit characteristics and is resistant/tolerant to a number of diseases that constrain tomato production. It is therefore ideal for greenhouse cultivation and should be promoted in target areas
Region promoted	Kirinyaga (Mwea, Kagio), Kiambu Kajiado, Muranga, Nairobi, Trans Nzoia, Uasin Gishu, Kisumu
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers Extension Service Providers, County Government, Farmer Groups/CBOs and NGOs Traders, Processors
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• Stakeholder training</li> <li>• Field demonstrations</li> <li>• ASK shows</li> <li>• Field days</li> <li>• Farmer field schools</li> <li>• Radio/TV broadcasts</li> </ul>

	<ul style="list-style-type: none"> <li>• Farmer research networks</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programs</li> <li>• Agricultural innovation platforms</li> <li>• Print media brochures</li> <li>• Conferences and journals</li> </ul>
Most effective approach	Farmer Participatory demonstrations, farmer field schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Adequate funds allocation for promotion activities.</li> <li>• Farmer, consumer, market and processing preference</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and market tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all year-round markets to motivate farmers.</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for variety</li> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	The variety has been adopted by farmers growing tomato in greenhouse in various Counties e.g. Kiambu, Murang'a, Kajiado, Nairobi, Machakos, Kitui, Trans-Nzoia, Bungoma
Counties where TIMP will be up-scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>-In-appropriate greenhouse structures</li> <li>-Variety not tolerant to emerging pests e.g. <i>Tuta absoluta</i> and problematic diseases such as bacterial wilt</li> </ul>
Suggestions for addressing the challenges	Need to introduce and evaluate heat stress and bacterial wilt tolerant varieties with acceptable characteristics for evaluation in target areas
Lessons learnt	<ul style="list-style-type: none"> <li>- Previous experience has shown that Farmer participatory approach works</li> <li>-Greenhouse tomato cultivation requires expertise</li> <li>-Group managed greenhouses apparently have a high failure rate, so approach on individual farmer basis more sustainable</li> </ul>
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>-Organized marketing channels critical for benefits to be derived from technology</li> <li>-Greenhouse crop cultivation requires appropriate regulatory frameworks</li> </ul>
<b>D: Economic, gender, and vulnerable</b>	

<b>marginalized groups (VMGs) considerations</b>	
Basic costs	KES 400,000 (including cost of greenhouse)
Estimated returns	KES 500,000/ha (1st season)
Gender issues and concerns in development and dissemination	-The technology can be easily applied by all gender categories since the variety is suited for greenhouse production where activities are relatively easier to manage; should be attractive especially to youth but lack of capital to set up greenhouse structure could be a concern
Gender issues and concerns in adoption and scaling up	Some gender categories (e.g. youth and women) may be disadvantaged by lack of access to land and capital to put up a greenhouse
Gender related opportunities	- All gender categories can participate in growing tomato varieties in greenhouse - A lucrative commercial enterprise across the gender divide
VMG issues and concerns in development, dissemination, adoption and scaling up	- Inclusivity of VMGs is critical in the process to avoid perpetuation of marginalization - Lack of access to credit for initial capital cost of putting up greenhouse is a concern
VMG related opportunities	- It is a lucrative enterprise and if involved, VMGs will be availed opportunity to be gainfully engaged
<b>E: Case studies/profiles of success stories</b>	
Success stories	-Youth groups in Kiambu County and farmers in peri-urban Nairobi County are successfully growing this variety in greenhouse
Application guidelines for users	Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.
<b>F: Status of TIMP</b>	Requires validation
<b>F: Contacts</b>	
Contacts	Institute Director, Horticulture Research Institute P.O. Box 220-01000, Thika Tel. 020-2055038 E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>
Lead organization and scientists	KALRO/JKUAT: A. Ndegwa, John Wesonga, Rahab Magoti, Finyange Pole, Charity Gathambiri, Vincent Ochieng
Partner organizations	Royal Seed Co Ltd.; Simlaw Seeds Co. Ltd.; MoALF&C

### Research gap

1. Evaluation of existing tomato varieties and new introductions for adaptability (e.g. tolerance to heat stress) in target zones
2. Establishment of a database of tomato cultivars in the market

<b>2.1.12 TIMP name</b>	<b>Introduced Cherry tomato variety (Koko)</b>
Category	Technology
<b>A: Description of the technology, innovation or management practice</b>	

Problem to be addressed	Low productivity of Cherry Tomatoes in Kenya Lack of cherry tomato varieties adapted to local conditions for the local market. Only few cherry tomato varieties are available on the Kenyan market.
What is it? (TIMP description)	This is a high yielding and high quality tomato cultivar suitable for production under Kenyan conditions. The cultivar introduced from Japan has been evaluated at JKUAT, The variety takes 75 days to mature (start of harvesting), is indeterminate with long harvesting periods of up to 3 years. It is a round, red, sweet, flavoured fruit Adapted to varying climates. It has a yield potential of 2.5kg of fruit/plant per year (1.15ton/240m <sup>2</sup> greenhouse)
Justification	There is high market demand for the cherry tomatoes and several farmers are considering engaging in their production. The cherry tomatoes are consumed without cooking hence most nutrients are consumed without destruction compared to cooked varieties. The Cherry tomato are highly priced hence can contribute to high incomes for farmers. They are a rich source of lycopene, beta-carotene, folate, potassium, vitamin C, flavonoids, and vitamin E which makes them important in cardiovascular disease prevention. The variety has the desirable attributes and should be included in wider evaluation and promotion of cherry tomato in target areas
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, processors
Approaches to be used in dissemination	Newspaper, ASK shows, TV
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Validation through on farm trials with participation of farmers
Partners/stakeholders for scaling up and their roles	County Government - to provide extension services and funding; Seed companies - to provide improved certified seeds and varieties; Individual farmers- to grow and market tomatoes; Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers - to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Current extent of reach	Limited
Counties where already promoted, if any	Kiambu, Nyeri, Nakuru
Counties where TIMP will be up-scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	Limited knowledge on performance of the varieties in other locations
Suggestions for addressing the challenges	To undertake national performance trials and registration
Lessons learnt in up-scaling, if any	Cherry tomatoes are highly productive and are acceptable to the Kenyan Market
Social, environmental, policy and market	Approval by KEPHIS

conditions necessary for development and up-saling	
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 155,000/ha (variable costs)
Estimated returns	KES 750,000/ha gross margin
Gender issues and concerns in development dissemination, adoption and scaling up	Some gender categories (e.g. youth and women) may be disadvantaged by lack of access to capital to establish production
Gender related opportunities	All gender categories can participate in cherry tomato production Can be a good commercial enterprise across the gender
VMG issues and concerns in development, dissemination, adoption and scaling up	Lack of access to land and credit for cherry tomato production
VMG related opportunities	<ul style="list-style-type: none"> <li>- Cherry tomatoes are nutritious with antioxidant properties which would be beneficial especially to health challenged groups if engaged in growing and use. They are consumed directly ensuring bio-availability of the nutrients</li> <li>- It is a lucrative enterprise and if involved VMGs will be availed opportunity to be gainfully engaged</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Cherry tomatoes have been evaluated at JKUAT on a semi-commercial scale. Market survey was conducted and niche markets identified in Karen and various parts of Nairobi. There are several farmers who are keen to grow cherry tomatoes.
Application guidelines for users	Massodi, L., Nabi, S., Sharma, A., Singh, D. (2017). <i>Production Technology of Cherry Tomato in Kashmir</i> . ICAR-Central Institute of Temperate Horticulture Old Air Field, P.O. Rangreth, Srinagar-191132 (J&K), India
F: Status of TIMP readiness	2. Requires validation
<b>G: Contacts</b>	
Contacts	Jomo Kenyatta University of Agriculture and Technology (JKUAT), Department of Horticulture and Food Security
Lead organization and scientists	JKUAT, John M. Wesonga
Partner organizations	Wago Company Limited and IMG Co. Ltd, Japan, KALRO

### Research gap

1. Evaluation of existing cherry tomato varieties and new introductions for adaptability (e.g. tolerance to heat stress) in target zones
2. Establishment of a database of cherry tomato cultivars in the market


<b>2.1.13 TIMP name</b>	<b>Introduced cherry tomato variety (Chika)</b>
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Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Lack of cherry tomato varieties adapted to local conditions for the local market. Only few cherry tomato varieties are available on the Kenyan market.
What is it? (TIMP description)	This is a high yielding and high quality Cherry tomato cultivar suitable for production under Kenyan conditions. The cultivar introduced from Japan has been evaluated at JKUAT and has the following features: <ul style="list-style-type: none"> <li>• 75 days to maturity (start of harvesting),</li> <li>• Indeterminate with long harvesting period up to 3 years possible</li> <li>• Round, red, sweet, flavoured fruit</li> <li>• Adapted to varying climates.</li> <li>• Disease resistant.</li> <li>• Yield: 2.5 kg/ plant per year (1.15ton /240m<sup>2</sup> greenhouse)</li> <li>• Harvested 3 days per week</li> </ul>
Justification	The variety has desirable attributes and should be included in wider evaluation and promotion of cherry tomato in target areas. There is high market demand for the cherry tomatoes and several farmers are considering engaging in their production. The cherry tomatoes are consumed without cooking hence most nutrients are consumed without destruction compared to cooked varieties. The Cherry tomato are highly priced hence can contribute to high incomes for farmers.
Region promoted	Limited
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension service providers, traders, processors
Approaches to be used in dissemination	Newspaper, ASK shows, TV
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Validation through on farm trials with participation of farmers
Partners/stakeholders for scaling up and their roles	County Government - to provide extension services and funding; Seed Companies - to provide improved certified seeds and varieties; Individual farmers - to grow and market tomatoes; Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers – to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Current extent of reach	Limited
Counties where already promoted, if any	Kiambu, Nyeri, Nakuru

Counties where TIMP will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	Limited knowledge on performance of the varieties in other locations
Suggestions for addressing the challenges	To undertake national performance trials and registration
Lessons learnt in upscaling, if any	Cherry tomatoes are highly productive and are acceptable to the Kenyan Market
Social, environmental, policy and market conditions necessary for development and upsaling	Approval by KEPHIS required
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 663,840.00 /240m <sup>2</sup> (variable costs)
Estimated returns	KES 1,352,160/240m <sup>2</sup> gross margin
Gender issues and concerns in development, dissemination, adoption and scaling up	- Some gender categories (e.g. youth and women) may be disadvantaged by lack of access to capital to establish production
Gender related opportunities	- All gender categories can participate in cherry tomato production - Potential commercial enterprise across the gender
VMG issues and concerns in development, dissemination, adoption and scaling up	- Inclusivity of VMGs is critical in the process to avoid perpetuation of marginalization - Lack of access to land and credit for cherry tomato production
VMG related opportunities	- Cherry tomatoes are nutritious with antioxidant properties which would be beneficial especially to health challenged groups if engaged in growing and use. They are consumed directly ensuring bioavailability of the nutrients - It is a lucrative enterprise and if involved VMGs will be availed opportunity to be gainfully engaged
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	The cherry tomatoes have been evaluated at JKUAT on a semi-commercial scale. Market survey was conducted and niche markets identified in Karen and various parts of Nairobi. There are several farmers who are keen to grow cherry tomatoes.
Application guidelines for users	<ul style="list-style-type: none"> <li>• Ochieng, V., Wasilwa, L., Amata, Otipa, M., Lelgut, D., Wayua, F., Wasike, V., Musembi, F., Njihia, S., Bett, A. and Wadenje, J. (2016). <i>Tomato Production Manual</i> KALRO.</li> <li>• Massodi, L., Nabi, S., Sharma, A., Singh, D. (2017). <i>Production Technology of Cherry Tomato in Kashmir</i>. ICAR-Central Institute of Temperate Horticulture Old Air Field, P.O. Rangreth, Srinagar-191132 (J&amp;K), India</li> </ul>
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires	2. Requires validation

validation; <b>3.</b> Requires further research	
<b>G: Contacts</b>	
Contacts	Jomo Kenyatta University of Agriculture and Technology (JKUAT), Department of Horticulture and Food Security
Lead organization and scientists	JKUAT, John M. Wesonga
Partner organizations	Wago Company Limited and IMG Co. Ltd, Japan, KALRO

## 2.2 Seed Systems

<b>2.2.1TIMP Name</b>	<b>Raising clean tomato seedlings in nursery beds</b>
Category	Management practice
<b>A: Description of the management practice</b>	
Problem addressed	Loss of seeds in the nursery and lack of clean and quality tomato seedlings
What is it? (TIMP description)	<p>The management practice entails the step-by-step process of nursery site selection, preparation of beds, nutritional aspects, solarization use of bio-pesticides sowing of the seeds, and cover with insect-proof net and management of the nursery up to the time the seedlings are ready for transplanting. Nursery beds should be 1m in width and convenient length.</p> 
Justification	Clean and quality planting material is a prerequisite for successful tomato production. However, use of poor-quality seedlings obtained from non-reputable sources is rampant. Some farmers also use “own seed” or “ <i>Kukamua mbegu</i> ” which is a wrong practice that should be discouraged. Tomato farmers require sensitization on the importance of raising clean seedlings properly on-farm using certified seeds of preferred varieties.
<b>B: Assessment of dissemination and scaling up /out approaches</b>	

Users of TIMP	Farmers, commercial vegetable nursery operators, research organizations,
Approaches used in the dissemination	<ul style="list-style-type: none"> <li>• On-farm trials and Demonstrations</li> <li>• Field days</li> <li>• Farmer research networks</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programs</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> <li>• Digital platforms</li> <li>• Farmer Field and Business Schools (FFBS)</li> <li>• Agricultural innovation platforms</li> <li>• Print media brochures</li> </ul>
Critical/essential factors for successful promotion	<p>Collaboration between all partners</p> <p>Adequate facilitation: funds, logistics (transport)</p>
Partners/stakeholders for scaling up and roles	County Government - to provide extension services and funding; Seed companies - to provide improved certified seeds and varieties; Individual farmers - to grow and sell tomatoes, Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers - to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Counties where already promoted	Kirinyaga, Machakos, Kitui, Meru, Busia
Counties where TIMPS should be up scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	-Lack of adherence to recommendations even after capacity building in areas where promoted
Suggestions for addressing the challenge	<p>-Continuous capacity building and practical demonstrations</p> <p>-Emphasis on the dangers of using poor-quality seedlings</p>
Lessons learnt in up-scaling if any	- Farmer participatory approach and continuous capacity building are necessary
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Favorable environmental conditions</li> <li>• Willingness of stakeholders to participate</li> <li>• Producers are organized in groups to ensure that management practices are effectively up-scaled.</li> <li>• Regulatory bodies to direct the quality of seed.</li> </ul>



<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 20,000 (12m <sup>2</sup> Nursery)
Estimated returns	KES 3 per seedling
Gender issues and concerns in development, dissemination, adoption and upscaling	<ul style="list-style-type: none"> <li>• Some farmers use poor-quality seedlings obtained from non-reputable sources while others use own seeds</li> <li>• Tomato farmers use poor quality seeds due to lack of established seed system for the crop</li> <li>• High cost of nursery establishment and operation limits the involvement of women and youth.</li> <li>• Women have limited access to agricultural and extension services hence they might not have adequate knowledge on the need of quality seed</li> <li>• Women might not be able to understand the tomato written training materials due to high levels of illiteracy</li> <li>• Men are the land owners and they might not have no interest in tomato farming</li> <li>• The training materials and strategies need to be favourable for all gender</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Setting up of commercial nurseries by youth and women groups</li> <li>• The technology is easy to be upscaled by women and youth.</li> <li>• The TIMP has the potential of improving food security and nutrition for VMG families</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• High nursery operation costs limit the involvement of VMGs</li> <li>• VMGs have limited access to agricultural and extension services hence they might not have adequate knowledge on the need of quality seed</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Development partners to avail funds to VMGs for capacity building on nursery management</li> <li>• Setting up of commercial nurseries by youth and women groups</li> <li>• The TIMP has the potential of improving food security and nutrition for VMG families</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Farmers who were sensitized in the pilot phase of the MIAC project are practicing good nursery management. Cases to note are individual farmers and groups who are engaged in commercial tomato nursery business in major tomato growing areas

Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guide on tomato nursery management have been documented
<b>F. Status of TIMPS readiness</b>	(1) Ready for up-scaling
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO, A. Ndegwa; Rebecca Faraay, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&C

**Gap**

1. Demonstration of management practices in new target areas required

<b>2.2.2 TIMP name</b>	<b>An improved technique for raising high-quality clean tomato seedlings in a greenhouse</b>
Category (i.e. technology, innovation, or management practice)	Technology
<b>A: Description of the technology, innovation, or management practice</b>	
Problem to be addressed	Loss of seeds (low germination percentage) and seedlings to pests and diseases during propagation and transplanting.
What is it? (TIMP description)	Structure and process of raising clean tomato seedlings in a greenhouse in normal beds prepared on the soil or containers (seedling boxes, trays, pots) filled with growing media such as coco peat, pumice, humix, and sterilized soil. The seedling trays are held on raised base. The system is equipped with a misting system for watering using a fine mist to avoid injury to the delicate seedlings. Three days after emerging, the seedlings are supplied with a dilute solution of complete fertilizer nutrient solution. The seedlings are maintained for a period of three weeks after which water application frequency is reduced to harden the seedlings. The propagation area is secured and access strongly controlled to avoid the introduction of pests and pathogens into the seedlings.

	 <p>Protected tomato nursery structure</p>  <p>Seedlings ready for transplanting</p>
<p>Justification</p>	<p>Clean planting material is a prerequisite for successful tomato production. Use of poor-quality seedlings obtained from non-reputable sources. Raising seedlings in a greenhouse in containers is more efficient for space (can be placed on shelves)</p> <p>This technology promotes higher (80-90%) germination percentage compared to 70% in conventional nursery beds in the field. It produces seedlings which have big uniform root mass, stronger and vigorous hence low incidence of transplants drying. The system enable the faster establishment of crops to optimize the use of limited water occasioned by climate change. It also reduces damping off in the seedlings</p>
<p><b>B: Assessment of dissemination and scaling up/out approaches</b></p>	
<p>Users of TIMP</p>	<p>Farmers, commercial vegetable nursery operators</p>
<p>Approaches to be used in the dissemination</p>	<ul style="list-style-type: none"> <li>● Stakeholder training</li> <li>● Field demonstrations</li> <li>● ASK shows</li> <li>● Field days</li> <li>● Farmer field schools</li> <li>● Radio/TV broadcasts</li> <li>● Farmer research networks</li> <li>● Farmer to farmer</li> <li>● Mass media – Agricultural programs</li> <li>● Agricultural innovation platforms</li> <li>● Print media brochures</li> </ul>

	<ul style="list-style-type: none"> <li>• Conferences and journals</li> </ul>
Most effective approach	Farmer participatory demonstrations, Farmer field schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Collaboration between all partners</li> <li>• Financial support.</li> <li>• Farmer, consumer, market and processing preference</li> <li>• Choice of methods for promotion.</li> <li>• Successful validation of technologies</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding</li> <li>• Seed Companies - to provide improved certified seeds and varieties</li> <li>• Individual farmers - to grow and sell tomatoes</li> <li>• Farmer groups/CBOs to link farmers with other stakeholders, the source for inputs jointly and seek market outlets</li> <li>• Marketers – to provide good all-year-round markets to motivate farmers.</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Seed inspection</li> <li>• Processors-Create demand for a variety</li> <li>• Donors: Funding and technical backstopping</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Kajiado, Nakuru- Adopted by some individual farmers and some agro-preneurs as a business but requires up-scaling
Counties where TIMP will be upscaled	Kajiado, Elgeyo- Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Capital cost in setting up greenhouse/shade-house structure may be prohibitive for many farmers</li> <li>• Cocopeat and other soilless media are not readily available at local vendors.</li> <li>• Lack of access to credit for farmers</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Tailor-made financial solutions to assist in setup of structures.</li> <li>• Work with soilless media merchants to vail their produce at local stores.</li> </ul>
Lessons learnt in upscaling, if any	<ul style="list-style-type: none"> <li>• Farmers are very eager to adopt and move from old conventional methods to modern methods.</li> </ul>
Social, environmental, policy, and market conditions necessary for	<ul style="list-style-type: none"> <li>• Organized marketing channels are critical for benefits to be derived from technology</li> <li>• Willingness of stakeholders to participate</li> <li>• Regulatory bodies like KEPHIS to flow of certified seed.</li> <li>• Farm input costs are within the reach of farmers</li> </ul>

the development and upscaling	
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 30,000
Estimated returns	KES 60,000 per 4 weeks
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Gender inequality on land ownership</li> <li>- Women and youth have limited access to productive resources such as land, irrigation equipment, credit, and quality seeds</li> <li>- Women and youth have limited access to education, training and extension services than men</li> <li>- Seminars and workshops mostly attended by men</li> <li>- High cost of nursery establishment and operation limits the involvement of women and youth.</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>- All gender categories can participate in greenhouse tomato nursery management which has potential to be undertaken as a business</li> <li>- Employment opportunity for youth and women groups</li> <li>- Seedling production is an intensive high revenue which can empower women</li> <li>- The TIMP has potential of increasing production for women and youth and improving food security and nutrition for families</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited access to productive resources such as land so might not be able to adopt the TIMP</li> <li>• VMGs have limited access to agricultural and extension services hence they might not have adequate knowledge on raising seedlings in the greenhouse</li> <li>• VMGs might not understand the benefits of raising seedlings in the green house since they are usually left out when important decisions are being made relating to agricultural information</li> <li>• The training materials and strategies need to be favorable for VMGs</li> <li>• VMG will need financial support to establish nursery business</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Management of tomato nursery in greenhouse could be a good enterprise for commercialization by VMGs</li> <li>• Business can be conducted entirely on site where clients place orders and collect at site, not labour intensive</li> <li>• Seedling production is an intensive high revenue which can empower VMG</li> <li>• Raising seedlings in the green house has the potential of improving food security and nutrition for VMG families</li> </ul>

<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Individual farmers and agropreneurs are successfully doing commercial seedling production for horticultural crops including tomato e.g. Kajiado (Plant raisers in Isinya), Kiambu (farmer recently featured on smartfarm segment on Citizen TV), Naivasha (Longonot nurseries).
Application guidelines for users	Brochure and fact sheet with a detailed guide on greenhouse-tomato nursery management are documented
F: Status of TIMP readiness	2. Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO/JKUAT Rahab Magoti, John Wesonga, A. Ndegwa, Rebecca Faraay
Partner organizations	MoALF&C, Seed Companies (e.g. Sygenta, Kenya Highland Seed Company, Amiran, Simlaw Seeds), Agro-tunnel Ltd

### Research Gaps

1. Assessment of local substrates for tomato seedling production
2. Development of a container-less seedling production system
3. To assess the performance of the technique at farm level and identify any challenges faced by the farmers
4. Develop resources such as growers' manual for use by growers and consultants

## 2.3 Agronomic practices

2.3.1 Technology name	Recommended spacing in an open field
Category	Management practices
<b>A: Description of the technology, innovation, or management practice</b>	
Problem addressed	Reduced yield caused by inappropriate spacing methods used by farmers
What is it? (TIMP description)	-The recommended spacing of tomatoes in the open field is 60-90cm between rows and 45-60 cm between plants in shallow holes that are 20 cm deep and 20 cm wide.
Justification	Tomato farmers currently use inappropriate spacing and hence fail to achieve optimum plant density and the

	potential yields of the recommended varieties. Optimal plant density depends on variety, length of the growing cycle, seasonal changes in the light, climate and training and pruning of the crop There is a need for demonstration and capacity building on the right spacing of tomatoes for rain-fed cultivation to achieve high yields.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension Service providers
Approaches used in the dissemination	Farmer training, Farmer participatory demonstrations, Farmer field schools
Most effective approach	Farmer participatory demonstrations, Farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up if any	County Government - to provide extension services and funding; Seed companies - to provide improved certified seeds and varieties; Individual farmers - to grow and sell tomatoes; Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers - to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Counties where already promoted	Major tomato growing Counties: Kirinyaga, Kajiado
Counties where TIMPS should be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	Farmers may modify the recommendation due to associated practices e.g. irrigation mode
Suggestions for addressing the challenge	Reviewing/adjusting recommendations but still optimizing plant population
Social, environmental, policy and market conditions necessary	Organized marketing is critical for benefits of the recommendation to be derived
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	

Basic costs	KES 155,000/ha
Estimated returns	KES 750,000/ha (Gross margin)
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited access to productive resources such as land, credit, and other inputs</li> <li>• Women and youth have limited access to education, training and extension services, hence might not be aware of recommended spacing for tomatoes</li> <li>• Lack of awareness of the benefits of planting tomatoes in rows may lead to low adoption of the technology by women</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Train women and youth to be lead farmers and part of the FFBS ToT team for training on the importance of using recommended spacing for increased tomato yields</li> <li>• Train women and youth agricultural extension officers to be part of FFBS ToT team</li> <li>• Make simple training materials with illustrations to enhance communication</li> <li>• Adoption will lead to increased tomato production and hence improved food and nutrition security</li> <li>• All gender categories can participate in tomato transplanting</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Tomato planting is labour intensive for VMGs to undertake especially for those abled differently</li> <li>• Due to prejudice associated with their social status, VMGs are excluded from access to and benefits from improved technologies. Thus, affirmative action is required to promote the maize crop for the VMGs including value addition aspects.</li> <li>• VMG groups could have limitations in accessing the knowledge, resources for implementing tomato spacing</li> <li>• VMG have less access to extension training as they are not given equal opportunities, so they might not be aware of the TIMP</li> <li>• VMGs have no finances to pay for hired labour due to limited access to credit facilities</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> </ul>
VMG related opportunities	<p>-VMGs who are active and physically able can be gainfully engaged in tomato transplanting</p> <ul style="list-style-type: none"> <li>• Using recommended tomato planting will make it easy to work in the tomato farms</li> </ul>

	<ul style="list-style-type: none"> <li>• Train VMGs to be lead farmers and part of the FFBS ToT team for training on the importance of using recommended spacing for tomatoes</li> <li>• Train VMGs agricultural extension officers to be part of FFBS ToT team</li> <li>• Connect VMGs them to financial sources</li> <li>• Make friendly training materials with illustrations to enhance communication</li> <li>• There would be increased production of tomato hence improved food and nutrition security</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	-Farmers in major tomato growing areas were sensitized on proper spacing recommendations in previous initiatives such as the MIAC and ADSP projects
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with a detailed guide on recommended tomato spacing are documented
<b>F: Status of TIMPS readiness:</b> 1) Ready for up-scaling; 2) Requires validation; 3) Requires further research	Requires validation
<b>F: Contacts</b>	
Contacts	
Lead organization and scientists	KALRO, A. Ndegwa, Rahab Magoti, Rebecca Faraay
Partner organizations	MoALF&C

### Gap

2. Validation/Demonstration of management practices in new target areas required

<b>2.3.2 TIMP Name</b>	<b>Staking and pruning in an open field</b>
Category (i.e. technology, innovation or management practice)	Management practices
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Reduced yield due to lack of proper information and skills on tomato plant management

What is it? (TIMP description)

### Pruning indeterminate tomato

This is the deliberate plucking of extra branches of the crop. The main stem of the tomato plant branches into two after the first flower cluster. Removal of excess fruits by de-flowering is also recommended as it results in larger tomatoes at harvest that can fetch good price. In case a knife is used, first disinfect the knife by dipping in 5% JIK after every cut. When 6 to 8 flowers form, the growing tip should be pinched off to encourage growth of new side shoots.



#### Staking



#### De-suckering



#### De-foliation

**Staking:** For the semi-determinate varieties put a 2m stake firmly into the ground and loosely tie seedling to the stake. For indeterminate varieties, put a strong stake in the ground at every four metres and fix two wires running lengthwise along the rows one at a height of 0.5m and another at 2m above the ground level Train the tomato plants up the wires using poly twine

Justification

Pruning is essential, especially in greenhouse varieties. Lack of pruning results in small fruits. Staking is necessary for the

	semi-determinate varieties Proper pruning, staking, or trellising tomato plants provides plant support, keeps the fruit and foliage off the ground and allows adequate absorption of sunlight by the plant. It eases spraying and harvesting, reduces disease incidence, fruit rot and increases fruit size and ultimately fruit yield. Tomato farmers need to be capacity built on these agronomic practices.
<b>B: Assessment of dissemination and scaling up /out approaches</b>	
Users of TIMP	Farmers, Extension service providers
Approaches used in the dissemination	<ul style="list-style-type: none"> <li>• Stakeholder training</li> <li>• Field demonstrations</li> <li>• Field days</li> <li>• Farmer field schools</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programs</li> <li>• Agricultural innovation platforms</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Availability of stakes and poly-twines</li> <li>• Choice of tomato variety</li> </ul>
Partners/stakeholders for scaling up and roles	<ul style="list-style-type: none"> <li>• County Government - to provide extension services and funding; Seed companies - to provide improved certified seeds and varieties; Individual farmers - to grow and sell tomatoes;</li> <li>• KEFRI -To give permission for harvesting of stakes</li> <li>• Plastic manufacturing companies (Production of plastic stakes)</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted	Kajiado, Garissa, Siaya, Elgeyo-Marakwet
Counties where TIMPS should be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• The stakes are very costly to the environment</li> <li>• The stakes are eaten by termites and are only season-long</li> </ul>
Suggestions for addressing the challenge	<ul style="list-style-type: none"> <li>• The use of plastic mulch is a solution to the cutting of trees and termites</li> </ul>
Lessons learned in upscaling if any	Most high-yielding tomato varieties have the need for staking.
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Staking materials should be readily available without any threat to the environment by integrating crop and agroforestry</li> <li>• Willingness of stakeholders to participate</li> </ul>

	<ul style="list-style-type: none"> <li>• Regulatory bodies like KEFRI to ensure sustained tree planting where some have been cut.</li> <li>• Availability of market to purchase produce after high yields are realized.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The management practice might have an element of drudgery for some gender categories (women) since it requires physical exertion to put stakes in place</li> <li>• Women and youth have limited access to productive resources such as land, credit, and other inputs</li> <li>• Women and youth have limited access to education, training and extension services, hence might not be aware of the importance of staking and pruning in tomatoes</li> <li>• Lack of awareness of the benefits of staking and pruning in tomatoes may lead to low adoption of the technology by women</li> </ul>
Gender-related opportunities	<ul style="list-style-type: none"> <li>• Train women and youth to be lead farmers and part of the FFBS ToT team for training on the importance of using recommended spacing and planting density for increased tomato yields</li> <li>• Train women and youth agricultural extension officers to be part of FFBS ToT team</li> <li>• Make simple training materials with illustrations to enhance communication</li> <li>• Adoption will lead to increased tomato production and hence improved food and nutrition security</li> <li>• All gender categories can participate in staking and pruning of tomatoes.</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The management practice could be tedious for some VMGs (the elderly, ailing, and physically challenged) since it requires physical exertion to put stakes in place</li> <li>• Due to prejudice associated with their social status, VMGs are excluded from access to and benefits from improved technologies. Thus, affirmative action is required to promote the tomato crop for the VMGs including value addition aspects.</li> <li>• VMG groups could have limitations in accessing the knowledge, resources for implementing tomato pruning and staking</li> </ul>

	<ul style="list-style-type: none"> <li>• VMG have less access to extension training as they are not given equal opportunities, so they might not be aware of the TIMP</li> <li>• VMGs have no finances to pay for hired labour due to limited access to credit facilities</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• VMGs who are active and physically able can be gainfully engaged in tomato staking and pruning</li> <li>• Train VMGs to be lead farmers and part of the FFBS ToT team for training on the importance staking and pruning tomatoes</li> <li>• Train VMGs agricultural extension officers to be part of FFBS ToT team</li> <li>• Connect VMGs to financial sources</li> <li>• Make friendly training materials with illustrations to enhance communication</li> <li>• There would be increased production of tomato hence improved food and nutrition security</li> </ul>

#### **E: Case studies/profiles of success stories**

Success stories from previous similar projects	Some farmers who were sensitized in the pilot phase of the MIAC project are practicing staking and pruning of tomatoes regularly
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with a detailed guide on staking and pruning are documented
<b>F. Status of TIMPS readiness</b>	Ready for up scaling
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO- A. Ndegwa, Rahab Magoti Rebecca Faraay,
Partner organizations	MoALF&C

#### **Research gaps**

1. Determination of the effect of deflowering on number and size of tomato fruits
2. Determination of the effect of defoliation on number and size of tomato fruits

<b>2.3.3 TIMP name</b>	<b>Improved greenhouses for production of high quality tomatoes</b>
Category	Technology

**A: Description of the technology, innovation or management practice**

Problem to be addressed

Low returns and poor yields from the cultivation of tomatoes in Greenhouses are brought about by lack of information on greenhouse farming and the use of wrong structures.

What is it? (TIMP description)

The improved greenhouses measures 8m by 30m with a the top covered in plastic cladding material, has a top vent and is covered with a shade net. The sides are covered with an insect-proof net with a roller-up system made of plastic cladding material. It has a double-door entrance porch system to assist in the containment of pests. It is equipped with a timed irrigation system that supplies water or nutrient solution at planned intervals for a set duration. It is equipped with sensors for weather conditions namely radiation, temperature, and relative humidity to enable growers to monitor the greenhouse weather conditions and use the information for decision-making.



Justification

Greenhouses are a high-value crop, yield-intensive structures. They guarantee higher returns per unit area.

The improved greenhouse offers a better growing environment and provides better crop hygiene. It also provides a better work environment for the growers. The greenhouse, therefore, provides the better condition for

	higher productivity and better quality and requires validation in target areas.
Region promoted	None
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Growers of high-value horticultural crops, service providers involved in greenhouse construction, farmers, County governments
Approaches to be used in the dissemination	<ul style="list-style-type: none"> <li>• Stakeholder training</li> <li>• Field days and field demonstrations</li> <li>• Farmer field schools</li> <li>• Radio/TV broadcasts</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programs</li> <li>• Agricultural innovation platforms</li> <li>• Print media brochures</li> </ul>
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Acceptance of greenhouse farming</li> <li>• Availability of materials for greenhouse construction and sustenance.</li> </ul>
Partners/stakeholders for scaling up and their roles	<p>Greenhouse construction companies – to construct greenhouses financial institutions- to fund the establishment of greenhouses</p> <p>Seed companies - to provide improved certified seeds and varieties</p> <p>Individual farmers - to embrace greenhouse farming</p> <p>Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets</p> <p>Marketers- to provide viable all-year-round markets at good prices that spur the growth of the crop</p>
<b>C: Current situation and future scaling up</b>	
Counties were already promoted if any	Kiambu, Siaya and Nyeri
Counties where TIMP will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya,



Challenges in dissemination	<ul style="list-style-type: none"> <li>• Limited local competence in the construction of suitable greenhouses</li> <li>• Skeptic approach from the farmers on whether the greenhouse will work.</li> <li>• High cost of greenhouse variety seedlings.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Capacity building and co-development of the new greenhouses educating farmers on the returns of greenhouse tomato production.</li> <li>• Educating farmers on why greenhouse tomato seedlings are expensive and the eventual ROI</li> </ul>
Lessons learned in upscaling if any	Different regions have different greenhouse modifications depending on the prevailing environmental conditions.
Social, environmental, policy, and market conditions necessary for the development and upscaling	<ul style="list-style-type: none"> <li>• Varied preference between open field and greenhouse varieties.</li> <li>• Enforcement of policy to curb fake seeds for high capital ventures like greenhouses.</li> <li>• Prevailing environmental conditions determine the type of greenhouse structure to be built.</li> <li>• Availability of material for the construction of greenhouses.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KSh. 1,478,180 for 240sq.m. greenhouse. This is an capital investment cost that should be discounted for a period of at least 3 years
Estimated returns	KSh. 1,352,160 for 240sq.m. greenhouse
Gender issues and concerns in development, dissemination, adoption and scaling up	High cost of coffee establishment may not favour VMGs
Gender related opportunities	<ul style="list-style-type: none"> <li>• Decision making on land use is done by men, limiting women and youth participation in green house technology uptake</li> <li>• Training of youths as agri-preneurs to offer specialized greenhouse installation services at a fee</li> <li>• Employment as casual laborers during greenhouse establishment</li> <li>• The greenhouse enables high productivity and quality hence can be a good avenue for empowering women</li> <li>• Greenhouse has an improved working environment conducive for women working.</li> </ul>

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs need financial and farm operational support for the adoption of the technology</li> <li>• Affirmative institutional support to promote adoption, dissemination and scaling up of the technology</li> <li>• Establish special Agricultural Innovations Platforms (AIPs) for the VMGs</li> <li>• High initial capital requirement may be a barrier for adoption by VMG.</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Training of VMGs as TOTs to reach out to the other VMGs farmers</li> <li>• Greenhouse enables high productivity and quality hence can be a good avenue for empowering VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	The greenhouses have been constructed by some farmers in Nyeri, Nairobi and Machakos. Greenhouses done by Vintage green company
Application guidelines for users	Construction details and specification will be documented into a resource book
F: Status of TIMP readiness	Requires validation
<b>G: Contacts</b>	
Contacts	Jomo Kenyatta University of Agriculture and Technology (JKUAT), Department of Horticulture and Food Security
Lead organization and scientists	JKUAT, John M. Wesonga, Urbanus Mutwiwa
Partner organizations	Wago Company Limited and IMG Co. Ltd, Japan, Vintage Green Ltd, KALRO

### Research Gaps

1. There is need to study greenhouse ecology in order to understand the interaction between the biotic and abiotic factors for optimizing production in the greenhouse
2. Evaluation of other designs and materials in order to lower costs
3. Study of greenhouse ecology in order to understand the interaction between the biotic and abiotic factors for optimizing production in the greenhouse
4. Evaluation of alternative low-cost greenhouse structural designs and materials

<b>2.3.4 TIMP name</b>	<b>Coco-peat based intensive tomato production</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Many soils where tomatoes are grown are contaminated with soil borne pathogens including bacterial wilt and nematodes

<p>What is it? (TIMP description)</p>	<p>This entails the use of cocopeat for growing of tomatoes. The cocopeat is sourced from the local market and washed to remove excess salts. The substrate is placed in growth containers or troughs to which tomato seedlings are transplanted and grown.</p>  <p>Cocopeat</p>  <p>Coco-peat in growth containers</p>
<p>Justification</p>	<p>Cocopeat has very good water holding capacity, is light weight and has good aeration. It is free from pests and disease causing organisms hence a good starting point for growers to minimize the need for application of pesticides to control pests. It has higher productivity compared to soil. The water holding capacity enables water saving making it climate smart.</p>
<p><b>B: Assessment of dissemination and scaling up/out approaches</b></p>	
<p>Users of TIMP</p>	<p>Growers of tomatoes and other horticultural crops, seedling propagators,</p>
<p>Approaches to be used in dissemination</p>	<p>Media including social media, Practical training, Demonstrations, farmers field schools</p>
<p>Most effective approach</p>	<p>Practical training, Demonstrations, farmers field schools</p>
<p>Critical/essential factors for successful promotion</p>	<p>Increase availability of cocopeat. Currently cocopeat is available in only few specialized shops and is imported</p>
<p>Partners/stakeholders for scaling up and their roles</p>	<p>County Government - to provide extension services and funding; Agro-dealers - to provide agro inputs including cocopeat; Individual farmers - to grow and sell tomatoes; Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers- to provide viable all year round markets at good prices that spur growth of the crop, Student interns, African Farmers Club to spur youth start-up ventures</p>
<p><b>C: Current situation and future scaling up</b></p>	
<p>Counties where already promoted, if any</p>	<p>Kiambu,Kajiado,Nairobi,Nakuru counties is widely used among large scale growers</p>

Counties where TIMP will be up scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya,
Challenges in dissemination	Availability of cocopeat at local level
Suggestions for addressing the challenges	NACOSTI chair on Manufacturing at JKUAT is working on development of local cocopeat to enhance availability and reduce costs
Lessons learnt in upscaling, if any	Coco peat have high PH they need to be cleaned well before use.
Social, environmental, policy and market conditions necessary for development and upscaling	Limited availability of cocopeat and high prices
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 600 per block of cocopeat
Estimated returns	Ksh 4000 from tomatoes (Each block produces 20 litre substrate that can support 8 tomato plants. Each tomato plant to generate Ksh 500 worth tomatoes)
Gender issues and concerns in development, dissemination, adoption and up scaling	<ul style="list-style-type: none"> <li>• Coco-peat based intensive tomato production was initiated to assist farmers with quality seeds of tomatoes and it is labor intensive especially for women whose work is complicated by their domestic roles</li> <li>• Women have limited access to productive resources such as cash to buy the coco-pit so they might not be able to adopt the TIMP</li> <li>• Women have limited access to agricultural and extension services hence they might not have adequate knowledge on Coco-peat based intensive tomato production</li> <li>• Women might not be able to understand the coco-pit written protocols due to illiteracy</li> <li>• Men are the land owners and they might have no interest in tomato since it is perceived as a women's crop</li> <li>• Use of coco-peat based intensive tomato production is laborious for women and they might not understand its benefits</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Adoption of Coco-peat based intensive tomato production has the potential of increasing production for women and youth</li> <li>• The TIMP has the potential of improving food security and nutrition for families</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Initial capital may hinder adoption by VMGs</li> <li>• VMGs have limited access to productive resources such as land so might not be able to adopt the TIMP</li> </ul>

	<ul style="list-style-type: none"> <li>• VMGs have limited access to agricultural and extension services hence they might not have adequate knowledge on Coco-peat based intensive tomato production</li> <li>• VMGs might not understand the benefits using Coco-peat based intensive tomato production since they are usually left out when important decisions are being made relating to agricultural information</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Coco-peat based intensive tomato production has the potential of increasing production for VMGs</li> <li>• The TIMP has the potential of improving food security and nutrition for VMG families</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Cocopeat is widely used in floriculture with high productivity and quality. It has potential for improving productivity of tomato production
Application guidelines for users	Guidelines for preparation and use of cocopeat in press
F: Status of TIMP readiness ( <b>1.</b> Ready for upscaling; <b>2.</b> Requires validation; <b>3.</b> Requires further research	<b>2.</b> Requires validation
<b>G: Contacts</b>	
Contacts	Centre Director FCRC -Muguga
Lead organization and scientists	KALRO Muguga Vincent Ochieng ,JKUAT, John M.Wesonga, Urbanus Mutwiwa, Boniface Muteshi
Partner organizations	Wago Company Limited and IMG Co. Ltd, Japan, KALRO

### Research Gaps

1. Assessment of suitability of local cocopeat
2. Optimization of fertilizer management using cocopeat
3. Assess the use of organic sources of such as FYM and compost with cocopeat

## 2.4 Natural Resource management

<b>2.4.1 TIMP name</b>	Rapid Soil Testing Services
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<p>Conventional methods for soil testing are expensive for farmers, results take long and are not reproducible. Further, conventional methods have not provided solutions for paired soil and leaf testing to determine health of soil and crop simultaneously.</p> <p>Current methods do not provide a framework for large scale assessment of geo-referenced sampled points using standardized protocols.</p>

	Limited access to soil testing services (centralized soil testing laboratories and high cost).
What is it? (TIMP description)	<p>This is a dry method for soil testing using the interaction of electromagnetic radiation with matter to characterize biochemical composition of a soil and/or plant tissue. It does not require the routine laboratory analysis using chemicals.</p> <p>When a sample is run through a scanner, soil testing results are generated with accompanying recommendations instantly.</p> <p>However, the method requires partners involved (ICRAF, iSDA and SoilCares) to work closely with KALRO and county agricultural officers to sensitize farmers to embrace the testing method.</p> <p>This innovation will involve working closely with agronomists to generate specific fertilizer recommendation driven by soil and crop data obtained.</p>
Justification	Soil testing is the basis for good fertilizer management that maintains the productivity of soil and improves the quality of crops. It promotes more efficient fertilizer use and prevents environmental pollution from excess fertilizer application, and cost efficiency. However, limited access to soil testing services is depriving the farmers' ability to make informed decisions with regard to soil management and fertilizer use.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension officers
Approaches used in dissemination	Farmer visits Training in workshops Publicity campaigns done at County levels
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Availability of the necessary equipment (Scanner and accessories) for rapid on-site soil testing.</li> <li>• Established rapport between farmers and the technical personnel involved in soil testing.</li> <li>• Adequate qualified staff to cover the large number of samples from the target 24 counties before the planting season begins.</li> <li>• A well-designed information storage system for data obtained at farm level including (GPS readings, physical description of the locations, raw measured scanned data, fertilizer recommendation according to crop type suitability).</li> <li>• Farmers must understand, trust, and be willing to act upon the information provided</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• County government extension services; Providing the link to farmers.</li> <li>• Soilcares; Provides soil scanners technology and capacity building in collaboration with KALRO and ICRAF,</li> </ul>

	<ul style="list-style-type: none"> <li>• ICRAF and iSDA; Tests and validate the recommendations obtained in collaboration with SoilCares and KALRO.</li> <li>• Fertilizer companies; To provide fertilizer blends according to soil health status</li> <li>• Agro dealers to stock required fertilizers that is readily available to farmers</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Technology has not been promoted though testing has been ongoing in a few counties
Current extent of reach	Minimal reach in Nyeri County
Counties where TIMP will be promoted	All 24 KSAP Counties
Challenges in dissemination	<ul style="list-style-type: none"> <li>• It requires continuous updating of methods to improve recommendations.</li> <li>• Lack of awareness on the importance of regular testing of soil quality</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Awareness creation, intensive farmer field training (capacity building)</li> <li>• Make the whole process cost efficient. Use of scanners (spectroscopy) and less wet chemistry analysis.</li> <li>• Automated methods for updating existing recommendations by generating local soil libraries.</li> </ul>
Lessons learned if any	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 Copper.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> <li>• Socially acceptable-brings income, increases food production, nutrition security and family cohesion.</li> <li>• Environmentally friendly; -Recommendations provided ensures that farmers only apply the required amounts of fertilizers. No excess nutrients to contaminate ground and surface water.</li> <li>• Market will absorb the increased productivity</li> <li>• Supporting frameworks/policies are available.</li> <li>• Training of personnel at national and County levels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<ul style="list-style-type: none"> <li>• Soil testing equipment and License, sampling and packaging materials (KES 650,000/=), personnel and logistics (will depend on site/location).</li> <li>• Shipping selected soil and plant materials for further testing and results verification in a certified lab.</li> <li>• There are other additional costs on professional consultation.</li> </ul>

Estimated returns	At least 30% profit for soil testing business venture using the scanner. Farmers end up getting higher returns on the crops grown and amounts depend on specific value chain. High value crops will give higher returns compared with subsistence crops.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• By bringing services closer to the users saves farmers (men, women and youth) time and resources.</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Offers employment especially for the youth where soil sampling champions will be trained to help the local community in sampling.</li> <li>• The scanner equipment is light and women and youth can easily transport and operate it.</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	Willingness to adopt and scaling up technology by VMGs given that farmers have not adopted current soil testing services due to distances and costs
VMG related opportunities	This is a TIMP that will bring soil testing services nearer to this group of farmers and therefore is a saving and is also expected to improve productivity
<b>E: Case studies/profiles of success stories</b>	
Success stories	Has been tested used successfully by other organizations like ICRAF, SoilCares & former Kenya Sugar Research Foundation. It has been adopted at Kenya cane testing centre for checking maturity level and quality of sugar cane
Application guidelines for users	<ul style="list-style-type: none"> <li>• A hand-held scanner to test soils and crops in the field</li> <li>• Community soil sampling champions are identified and trained on good soil sampling procedures.</li> <li>• Soil and crop is analysed and the results including fertilizer recommendation generated on site.</li> </ul>
<b>F: Status of TIMP readiness</b> (1=Ready for up scaling; 2=Requires validation; 3=Requires further research)	2 =Requires validation
<b>G: Contacts</b>	
Contacts	Director, Environment & Natural Resource Systems KALRO Secretariat P.O. Box 57811-00200 +254 722 206986/8, Ext 2316
Lead organization and scientists	KALRO; C. Kibunja, E. Gikonyo, Christy van Beek, A. Sila, D. Kamau, A. Esilaba and S. Kimani
Partner organizations	County governments in the 24 counties, SoilCares, ICRAF and iSDA

### Research gaps

1. Testing paired soil and crop samples to determine nutrients in the soil and what is available to plant.

2. Determine nutrient deficiency and make recommendation for the type of fertilizer to use and at what rate.
3. Developing a fertilizer recommendation system with options for new blends.
4. Working with fertilizer companies to produce fertilizer blends packaged in smaller quantities as per farmer needs.
5. 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.
6. Updating existing soil maps with newly acquired soil data to provide current soil fertility status in the country

<b>2.4.2 TIMP NAME</b>	<b>Integrated Soil Fertility Management (ISFM)</b>
Category (i.e. technology, innovation or management practice)	Management practices
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low yields due to declining soil fertility, low organic matter, poor soil structure and limited available moisture in crop production. Farmers lack knowledge on appropriate nutrient management in tomato cultivation
What is it? (TIMP description)	A set of soil fertility management practices that include the use of inorganic fertilizers and locally available organic inputs adapted to local conditions for then sustainable maintenance of high crop yields and soil fertility.
Justification	Continuous cultivation has led to soil degradation, resulting from over or under use of fertilisers. This has in turn resulted in declining crop yields. Judicious use of fertilisers and soil amendment can restore the soils and reverse the declining yields trend. Application of the correct fertiliser formulations and manures at the correct rates at time, ensures that the soil is maintained in proper chemical balance which improves this biological soil balance and nutrient availability for crop production. This also optimises the amounts of inputs required and hence the costs.
Users of TIMP	Farmers, extension agents, agro input suppliers
Approaches used in dissemination	Farmer trainings, Field demonstrations, Farmer field schools, AIPs, Digital platforms, Mass media
Most effective approach	Farmer participatory demonstrations, Farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners and stakeholder

	Adequate allocation of funds for promotional activities
Partners/stakeholders for scaling up and their roles	County Government - to provide extension services and funding; Seed companies - to provide improved certified seeds and varieties; Individual farmers - to grow and sell tomatoes; Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers - to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Counties where TIMP were already promoted if any	Major tomato growing Counties: Kirinyaga, Kajiado
Counties where TIMP will be up scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	Lack of knowledge on management and preparation of good quality manure, lack of access to information on the types, rates and application of inorganic fertilisers in tomato
Suggestions for addressing the challenges	Training on manure management and preparation for tomato production, sensitization on soil testing and fertilizer management in tomato production.
Lessons learnt in up-scaling if any	Previous initiatives indicated that farmer participatory approach in technology dissemination improves adoption levels
Social, environmental, policy and market conditions necessary	-Access to inputs (fertilizers, manure)
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 92,000/acre that is inclusive of 17, 500 for organic and inorganic fertilizers
Estimated returns	KES 300,000/acre in returns from tomato sales
Gender issues and concerns in development, dissemination adoption and scaling up	<p>The practice integrates participation of male and female gender roles during field activities. Women are disadvantaged where application of heavy loads of manure are to be incorporated in the field as it increases their workload</p> <p>Adoption and scaling up of ISFM technologies could be affected by the ownership of the farm as they are mainly male</p>


	<p>owned if the man does not accept the technology then there is usually no adoption.</p> <p>Women and youth have no/inadequate funds to purchase some of the ISFM inputs such as fertilisers due to limited access to credit facilities</p> <p>Women and youth have limited access to agricultural information and extension services hence they might not be aware of ISFM</p>
Gender related opportunities	<p>Apart from the inorganic fertilizers and good seed, the practice adopts other locally available materials that saves on cost which is good for all gender in the involved in tomatoes farming .</p> <p>ISFM technologies will increase tomato production hence creating employment for women and youth in the value chain</p> <p>ISFM will increased food security and nutrition for households due to the enhanced yields/production</p>
VMG issues and concerns in development, dissemination adoption and scaling up	<p>VMGs are physically disadvantaged for the labour intensive practice of incorporating manures, etc in the farm.</p> <p>VMGs are also resource poor and may not have the resources to purchase seed and fertilizers as required for successful implementation of the practice.</p>
VMG related opportunities	<p>The technology if well-practiced can increase farm incomes of VMGs by upto 50% to the benefit of the VMG households.</p> <p>The practice adopts other locally available materials that saves on cost which may be good for VMGs, who are less financially able.</p> <p>ISFM technologies will increase tomatoes production hence creating employment for VMGs along the tomato value chain</p> <p>Increased yields due to ISFM will increase food security and nutrition for VMGs</p>
E: Case studies/profiles of success stories	
Success stories	<p>Farmers who were sensitized in the pilot phase of the MIAC project are able to use the right amount, and placement of fertilizers to reduce negative effects of excessive or under</p>

	fertilization for higher yields.
Application guidelines for users	Ochieng V., Wasilwa L., Amata R., Otipa M., Lelgut D., Wayua F., Wasike V., Musembi F., Njihia S., Bett A. and Wadenje J. 2016. Tomato Production Manual  Ngosong, C. , M. Mfombep, P. , C. Njume, A. and S. Tening, A. 2015 Integrated Soil Fertility Management: Impact of Mucuna and Tithonia Biomass on Tomato ( <i>Lycopersicon esculentum</i> L.) Performance in Smallholder Farming Systems. <i>Agricultural Sciences</i> , 6, 1176-1186
F: Status of TIMPS readiness:	Ready for up-scaling
G: Contacts	
Contacts	Institute Director  KALRO HRI  O. Box 220, Thika 01000  Email: <a href="mailto:kalro.kandara@kalro.org">kalro.kandara@kalro.org</a>  Tel: 020 2055035
Lead organization and scientists	KALRO, Agnes Ndegwa Rahab Magoti, Rebecca Faraay
Partner organizations	MoALF&C, Agro-dealers

### Gap

3. Demonstration of management practices in new target areas required
4. Testing (fertilizer types, rates, frequencies) and combination with manures for different varieties

<b>2.4.3. TIMP name</b>	Low cost Composting technology
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Organic wastes constitute the highest percentage of waste flow in Kenya leading to big landfills especially near the urban centres. However, there is low awareness on appropriate low cost composting technologies and lack of supporting policies. Moreover, lack of proper composting management and handling leads to increased GHG emissions.
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

	<p>decayed organic matter called humus. Composting is thus one of the most effective process for recycling organic wastes intended for use in agriculture</p> 
<p>Justification</p>	<p>The decline in soil fertility in smallholder system is a major factor inhibiting agricultural development on farms. It is estimated that soils are depleted at annual rate of 22kg/ha for nitrogen, 2.5kg/ha for phosphorous, and 15kg/ha for potassium.</p> <p>Compost contain the nutrients nitrogen, phosphorus and potassium and 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</p>
<p><b>B: Assessment of dissemination and scaling up/out approaches</b></p>	
<p>Users of TIMP</p>	<p>Farmers, extension agents,</p>
<p>Approaches used in dissemination</p>	<p>On-farm and on-station demonstrations  Open and Field days  Agricultural shows  MoA/Extension officers  Partners  Farmer to farmer peer learning  Mass media  Workshops, Seminars, Meetings, trainings  Promotional materials (posters/brochures/leaflets)  Social Media platforms  Exchange visits</p>
<p>Critical/essential factors for successful promotion</p>	<ul style="list-style-type: none"> <li>• Training on management and use of manure</li> <li>• Dissemination approach used to reach target farmers</li> <li>• Model demonstration plots using several crops</li> </ul>
<p>Partners/stakeholders for scaling up and their roles</p>	<p>Ministry of Agriculture, Livestock, Fisheries &amp; Irrigation (MoALF &amp; I)-National and County level - extension services</p>


	<p>CIGs (Common Interest Groups)- co-ordination roles and back stopping at grass root levels</p> <p>ILRI- technical backstopping</p> <p>NGOs (Non-governmental organizations)-promotion, micro financing etc.</p>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Tharaka Nithi, Kajiado, Nyeri, Bomet, Uasin Gishu, Kakamega, Busia, Machakos
Current extent of reach	Though small scale farmers in the Counties do composting on their farms, they do not optimize on usage.
Counties where TIMP will be promoted	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Lack of model demonstration farms</li> <li>• Cultural challenges -Lack of interest by farming communities</li> <li>• Lack of continuity in training of extension and farmers in the skill for manure management</li> <li>• Lack of proper mobilization mechanism for reaching many farmers</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Establishment of many demonstration plot by counties</li> <li>• Capacity building of pastoral communities on manure management and its benefit</li> <li>• Continuous capacity building of demonstration farmers and extension workers</li> <li>• Use of approaches to mobilize farmer to attend demonstration forums</li> </ul>
Lessons learned if any	<ul style="list-style-type: none"> <li>• Proper use of manures improves soil fertility</li> <li>• Use of composts enhances crop productivity</li> <li>• Skills in composting, storage and application</li> </ul>
Social, environmental, policy and market conditions necessary	<p>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 through leaching of nutrients.</p> <p>Generally, composting saves on purchase of inorganic fertilizer, increases crop yield and saves water when used on the farm, hence socially and environmentally acceptable</p>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Preparation of composts require labour for building a compost heap, maintaining it and finally transporting and applying it field which take a lot of effort and time
Estimated returns	Returns dependent on crop and crop varieties in the value chain where composting is practised

Gender issues and concerns in development, dissemination, adoption and scaling up	It is labour intensive in terms of handling and application (often by broadcasting) hence may disadvantage women and youth
Gender related opportunities	Composting resources are locally available for farm households who keep livestock, hence opportunities available for both men and women.
VMG issues and concerns in development, dissemination, adoption and scaling up	It is labour intensive in terms of handling and application hence may disadvantage VMGs. The VMGs are also resource poor, hence may not have access adequate resources
VMG related opportunities	Materials for compost making include household wastes and only require one to be trained on composting techniques to ensure compost quality.
<b>E: Case studies/profiles of success stories</b>	
Success stories	Farmers who use composts in quickly maturing crops have reported 3 to 5 times increased production due and better income to improved soil health
Application guidelines for users	Kir, A. and Tepecik, M. (2020). The effect of different compost applications under organic management of tomato ( <i>Lycopersicon esculentum</i> L.) production in Turkey. <i>Acta Hort.</i> 1286, 73-82 Tabrika, I., Azim, K., Mayad, E. H., & Zaafrani, M. (2020). Composting of tomato plant residues: Improvement of composting process and compost quality by integration of sheep manure. <i>Organic Agriculture</i> , 10(2), 229-242.
<b>F: Status of TIMP readiness</b> (1=Ready for up scaling; 2=Requires validation; 3=Requires further research)	2 =Requires validation
<b>G: Contacts</b>	
Contacts	Director, Environment & Natural Resource Systems KALRO Secretariat P.O. Box 57811-00200 +254 722 206986/8, Ext 2316
Lead organization and scientists	KALRO S. Kimani, B. Mugo, E.Mutuma, D. Kamau, M. Okoti, J. Wamuongo, A.O. Esilaba
Partner organizations	County government, NGOs

### Research gaps

1. Promote composting technology in Counties that have not practised it.
2. Conduct nutrient budget study on selected farms using composts in the 24 Counties
3. Efficiency of composting types available to farmers
4. Different manure sources on tomato production and quality

<b>2.4.4 TIMP name</b>	Integrated Manure Management (IMM)
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Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<p>Land degradation characterized by the declining soil fertility, low yields, increased soil moisture stress, increased soil erosion and poor soil health</p> <p>Poor manure management and handling leading to increased Green House Gases (GHG) emissions</p>
What is it? (TIMP description)	<p>Integrated Manure Management (IMM) is the optimal, site-specific handling of livestock manure from collection, through treatment and storage up to application to crops.</p> <p>Manure is obtained from different animals (poultry, cow, goat, horse) on the farm, but it can also be bought from other farmers or at the market. When managed properly, it provides plant nutrients, builds soil organic matter, and improves soil physical properties all of which are important for soil quality and crop production.</p>  <p><i>Source: J. Oyoo, Tigoni</i></p>
Justification	<p>The decline in soil fertility in smallholder system is a major factor inhibiting agricultural development on farms. It is estimated that soils are depleted at annual rate of 22kg/ha for nitrogen, 2.5kg/ha for phosphorous, and 15kg/ha for potassium. Manure plays an essential role in the nutrient cycle where crops grow on land to feed livestock, which in return feeds the land with their manure. Recycling the (macro and micro) nutrients 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.</p> <p>Given the acute poverty and limited access to mineral fertilizers, manure has the potential providing the limiting nutrients and improving the soil health.</p> <p>The efficient use of manure is enhancing the capacity of the soil to conserve and accumulate soil organic carbon;</p>

	maintain or improve crop yield by supplying nutrients when required by plants and reduce effects of climate change through sequestration of carbon.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers Public and private practitioners
Approaches used in dissemination	On-farm and on-station demonstrations Open and Field days Agricultural shows MoA/Extension officers Partners Farmer to farmer peer learning Mass media- e.g Mkulima programme, Smart Farmer and Seeds of Gold Workshops, Seminars, Meetings, trainings Promotional materials (posters/brochures/leaflets) Social Media platforms Exchange visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Training on feeding, management and use of manure</li> <li>• Dissemination approach used to reach target farmers</li> <li>• Model demonstration plots using several crops</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture, Livestock, Fisheries & Irrigation (MoALF & I)-National and County level - extension services and link with farmers CIGs (Common Interest Groups)- co-ordination roles and back stopping at grass root levels ILRI- technical backstopping NGOs (Non-governmental organizations)-promotion, micro financing etc.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Tharaka Nithi, Kajiado, Uasin Gishu
Current extent of reach	Though small scale farmers in the counties apply manures and composts on their farms, they do not optimize on usage.
Counties where TIMP will be promoted	Bomet, Kericho, Laikipia, West Pokot, Taita Taveta, Nyandarua, Lamu, Tana river, Baringo, Marsabit, Garissa, Siaya, Kisumu
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Limited model demonstration farms</li> <li>• Cultural challenges -Lack of interest by pastoral communities</li> <li>• Lack of continuity in training of extension and farmers in the skill for manure management</li> <li>• Lack of proper mobilization mechanism for reaching many farmers</li> </ul>

Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Establishment of many demonstration plot by counties</li> <li>• Capacity building of pastoral communities on manure management and its benefit</li> <li>• Continuous capacity building of demonstration farmers and extension workers</li> <li>• Use of approaches to mobilize farmer to attend demonstration forums</li> </ul>
Lessons learned if any	<ul style="list-style-type: none"> <li>• Proper use of manures improves soil fertility</li> <li>• Use of manures enhances crop productivity</li> <li>• Skills in manure preparation, storage and application</li> </ul>
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> <li>• Applying manure to soils saves on purchase of inorganic fertilizer, increases crop yield and saves water.</li> <li>• Propagation of invasive species when the seed is ingested by the animal and passed to crop field</li> <li>• Manure can harbour pathogens which can cause disease outbreaks to livestock</li> <li>• Contamination of water sources by leaching of nutrients</li> <li>• Organic manures when poorly handled increase GHG emissions. However, IMM provides practices that are able to minimize GHG emissions.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<p>Proper handling of manure needs labour for collecting the manure, building a compost heap, maintaining it and finally transporting and applying it field which take a lot of effort and time. Manure costs are dependent on types e.g. goat, sheep, poultry</p> <p>Using locally available manure/composts saves on purchase of inorganic fertilizer.</p>
Estimated returns	Returns dependent on crop and crop varieties in the value chain where IMM is practised
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Manual is labor intensive in terms of handling and application (often by broadcasting) hence may disadvantage women</li> <li>• Decision on manure use and handling is dominated by men</li> <li>• Women lack appropriate knowledge on how to apply IMM in tomatoes farms</li> <li>• There will be increased labor intensity for women involved in carrying and spreading manure in the farms</li> <li>• Men dominate in decision making as to manure preparation in the households</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Employment opportunities for youth males in manure preparation and handling</li> </ul>

	<ul style="list-style-type: none"> <li>• Women have employment opportunities in manure application.</li> <li>• Increased production of tomatoes leading to improved livelihoods for women and youth</li> <li>• IMM technology id adopted has the potential of improving production of tomatoes leading to increased food security and nutrition for households</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• IMM is labor intensive in terms of handling and</li> <li>• The have limited access to resources such as finances to buy manure and other equipment used to handle manure due to limited access to credit facilities</li> <li>• The VMGs are also resource poor, hence may not have access to adequate manures due to lack of livestock</li> <li>• They have limited access to training and extension services on IMM</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Manure is locally available for those farm households with livestock and can build on household incomes by selling it.</li> <li>• Increased production of tomatoes leading to improved livelihoods for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Farmers who adopt manure management practice have reported improved soil health and increased crop yield, and sustainable source of income e.g. keeping one steer in a smallholder farm measuring 0.45ha in central Kenya produces manure equivalent to 112kgN/ha/year of whole farm area when optimum collection and manure composting strategies are followed.
Application guidelines for users	<ul style="list-style-type: none"> <li>•</li> </ul>
<b>F: Status of TIMP readiness</b>	Requires validation
<b>G: Contacts</b>	
Contacts	Director, Environment & Natural Resource Systems KALRO Secretariat P.O. Box 57811-00200 +254 722 206986/8, Ext 2316
Lead organization and scientists	KALRO S. Kimani, E.Mutuma, D. Kamau, M. Okoti, J. Wamuongo, A.O. Esilaba
Partner organizations	County government, Private Public Partnerships, CIGs

<b>2.4.5. TIMP name</b>	Rain water Roof water catchment
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	

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

Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Private sector – access to technology, access to credit, technology installation</li> <li>• County government – capacity building, policy support, credit facilities,</li> <li>• NGOs – access to technologies, capacity building, technology installation</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Most counties are investing on water harvesting technology at community level. More is required to increase uptake at household level
Current extent of reach	Practised widely in most counties
Counties where TIMP will be promoted	ASAL counties; Tana River, Marsabit, West pokot and Mandera
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High costs related to technology access and management</li> <li>• Resource use conflicts where land is communally owned</li> <li>• Limited skills in technology installation and management</li> <li>• Limited community mobilisation policy for water related activities</li> <li>• Lack of suitable training programmes in rainwater harvesting</li> <li>• Lack of proper water usage and control measures</li> <li>• In the case of earth dams where there is a lot of siltation, regular de-siltation is required.</li> <li>• Threats to sustainability of established systems because of lack of community participation in systems monitoring and maintenance.</li> <li>• Vandalism</li> <li>• Some systems require high investment costs</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Resource mobilization through partnerships with private sector</li> <li>• Engaging a participatory process during the planning and implementation of the project.</li> <li>• User specific training programs water harvesting technologies, maintenance and operation skills</li> <li>• Cost of buying water harvesting structures is very high for most households and needs to be reviewed.</li> <li>• Securing systems to prevent vandalism</li> </ul>
Lessons learned if any	<ul style="list-style-type: none"> <li>• Potential to cushion community against water scarcity</li> <li>• Improved productivity where water harvesting has been implemented</li> </ul>
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> <li>• Devise systems that are gender sensitive – target different gender needs</li> <li>• Carry out environment and social impact assessment of the technology in specific Counties and cultures</li> <li>• Support structures that help access to credit for technology access and maintenance</li> </ul>



	<ul style="list-style-type: none"> <li>• Enact Policy frameworks to support water harvesting</li> <li>• Enact policies on land tenure systems to support water harvesting</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Cost dependent on the type of materials to use for harvesting and storage. Not readily affordable to most rural households
Estimated returns	<ul style="list-style-type: none"> <li>• Time saved fetching water from afar is channelled into other economic enhancing activities.</li> <li>• Money used to treat diseases related to poor water hygiene is used for other activities.</li> <li>• Healthy population will have energy to provide labour required in agricultural activities</li> </ul>
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The distance from household need to be considered as women are the custodian of households in terms of domestic water demands.</li> <li>• The design of the water pans should take care of the Occupation, Health and Safety of the communities</li> <li>• The technologies will reduce time needed to fetch for water which will impact positively the women</li> </ul>
Gender related opportunities	Water harvesting facilities save the time spent to collect water from far off, usually by women. The saved time is channelled into other economic activities
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Limited access to credit or financial services may limit access to technology</li> <li>• The land tenure systems may inhibit adoption of technology</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Develop SME opportunities around water harvesting. Also do small food gardens and tree nurseries around water pans</li> <li>• VMG maximize can engage in n availability of water to engage in small IGAs around water harvesting</li> <li>• Livestock too easily access water and their market value likely to appreciate</li> <li>• The technology will reduce the time used to search for water</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	<p>Farmers who adopted water harvesting technology have had sustained source of income and improved livelihoods</p> <p>A typical African Water Bank rainwater harvesting system collects 400,000 to 450,000 litres of rainwater within two to three hours of steady rain. It has an artificial roof of 900 to 1,600 square metres and storage tanks. The largest tank constructed in Narok County has a capacity of 600,000 litres.</p> <p>This amount of water can serve a community of 400 people for approximately 24 months without extra rain. The capacity can be added at a rate of 220,000 litres per year. The system is low cost and can be 100 percent</p>

	maintained locally. It also uses local skills, labour, materials and technology. Apart from boosting access to water in arid and semi regions, rainwater harvesting contributes to water conservation thus reducing overexploitation of water resources.
Application guidelines for users	Handbook on Rainwater Harvesting and Storage Options Manual for Rooftop Rainwater Harvesting Systems in the Republic of Yemen
<b>F: Status of TIMP readiness</b> (1=Ready for up scaling; 2=Requires validation; 3=Requires further research)	1 =Ready for up scaling
<b>G: Contacts</b>	
Contacts	Director, Environment & Natural Resource Systems KALRO Secretariat P.O. Box 57811-00200 +254 722 206986/8, Ext 2316
Lead organization and scientists	KALRO, Isaya Sijali, J. Mwaura, P. Ketiemi
Partner organizations	County government, PPPs

### Research gaps

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

<b>2.4.6 TIMP Name</b>	<b>Mulching for weed management and moisture retention</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A:Description of the technology, innovation or management practice</b>	
Problem addressed	Accelerated loss of soil moisture-water stress in the soil, weed infestation, loss of organic matter, managing salinity in ASALS and low crop yields
What is it? (TIMP description)	Mulching is a soil surface management practice that reduce water loss through evaporation from the soil surface and also controls weeds. The different types of mulching techniques suitable for tomato include organic trash such as dry grass, crop residues and biodegradable polyethylene sheet. Mulch material should be placed on soil surface between rows and between plants within row leaving a small uncovered circle area around plant


	 
Justification	<p>Mulching conserves soil moisture, improves soil structure, reduces erosion and allows efficient use of fertilizers. It also suppresses weed growth thus reducing the labour cost on weed control. The use of mulch in tomato production shortens the period to maturity which is an advantage to the farmer. It is a practice that should be recommended to farmers and promoted to improve tomato production.</p>
<b>B: Assessment of dissemination and scaling up /out approaches</b>	
Users of TIMP	Farmers, Extension service providers
Approaches used in dissemination	Farmer trainings, Farmer participatory demonstrations, Farmer field schools
Critical/essential factors for successful promotion	<p>Collaboration between all partners</p> <p>Adequate facilitation: funds, logistics (transport)</p>
Partners/stakeholders for scaling up and roles	<p>County Government - to provide extension services and funding; Seed companies - to provide improved certified seeds and varieties; Individual farmers - to grow and sell tomatoes; Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers - to provide viable all year round markets at good prices that spur growth of the crop</p>
<b>C: Current situation and future scaling up</b>	

Counties where already promoted	Kirinyaga and Kajiado Counties
Counties where TIMPS should be up scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	Some mulching materials such as bio-degradable poeethylene may not be readily available to farmers
Suggestions for addressing the challenge	Improve access of mulching materials at local levels
Lessons learnt in upscaling if any	Practical demonstrations enhance adoption of recommended practices
Social, environmental, policy and market conditions necessary for up scaling	Open field tomato mulching practices can be undertaken using the many crop residue materials locally available as well as other appropriate materials if accessible to farmers
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 166,600/- per acre
Estimated returns	5 seasons with reduced irrigation, weeding and pests.
Gender issues and concerns in development, dissemination, adoption and up scaling	The management practice is easily practical for all gender categories
Gender related opportunities	All gender categories can participate in mulching tomato
VMG issues and concerns in development, dissemination, adoption and up scaling	-Laying out the mulching material may have an element of drudgery for some VMGs
VMG related opportunities	-
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	- Mulching has been adopted by some farmers in the marginal areas where tomato production is done
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guide on mulching in tomato are documented
<b>F. Status of TIMPS readiness</b> 1) Ready for up scaling; 2) Requires	2) Requires validation;

validation; 3) Requires further research	
<b>Contacts</b>	Institute Director KALRO HRI O. Box 220, Thika 01000 Email: kalro.kandara@kalro.org Tel: 020 2055035
<b>Lead organization and scientists</b>	KALRO Agnes Ndegwa Rahab Magoti, Charity Gathambitri, Finyage Pole
<b>Partner organizations</b>	MoAL&I

### Research gaps

1. Evaluation of bio-degradable materials for mulching in tomato\*
2. Testing of hydrogel polymer for moisture retention in tomato production systems

<b>2.4.7 TIMP name</b>	<b>Solar Irrigation Systems for smallholder farmers</b>
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	High cost of pumping water for irrigation, using electricity or fossil fuel powered pumps; reduction of greenhouse gas emissions
What is it? (TIMP description)	This is a technology that uses solar power in the pumping of irrigation water and running of the irrigation systems 
Justification	There has been general increase in prices of diesel and electricity making pumping of irrigation water to be a costly operation. Though Solar panels have been used successfully to light houses and in small businesses in the rural areas, they have hardly been used in the

	irrigation systems despite their potential. Solar power would be a good source of power for addressing climate smart agriculture focusing on renewable and green energy. It also has the advantage of low cost and sustainability.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers
Approaches used in dissemination	On-farm and on-station demonstrations Field days Training in workshops Stakeholders forums Technical releases
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Availability of quality water for irrigation</li> <li>• Access to solar irrigation performance data.</li> <li>• Improving solar irrigation systems efficiencies in irrigation schemes</li> <li>• Creating local support for solar irrigation technologies</li> </ul>
Partners/stakeholders for scaling up and their roles	County government extension services; Provide link with farmers. Community farmer groups; play coordination role for ease in problem identification and dissemination.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Various Counties including Marsabit, Garissa, Machakos, Nyeri, Kajiado, Siaya, Bomet, Kericho and Uasin Gishu
Current extent of reach	Practised in individual farms as well as in few group farms for high value crops like tomatoes
Counties where TIMP will be promoted	All the 24 KCSAP counties
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Farmers lack knowledge on the potential of solar as a power source for irrigation systems</li> <li>• High cost innovation</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Awareness trainings on different solar irrigation systems</li> <li>• Awareness creation on advantages of solar irrigation systems pumps to governments, farmers and development agencies.</li> <li>• Capacity building of extension workers</li> <li>• Developing information packages</li> <li>• Creating solar irrigation systems network</li> </ul>
Lessons learned if any	<ul style="list-style-type: none"> <li>• Solar irrigation systems should be well designed in water delivery, storage and application to the field.</li> </ul>
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> <li>• Practice is socially acceptable,</li> <li>• Environmentally friendly,</li> <li>• Policies are friendly to the technology</li> <li>• Capable of increasing marketable products</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Basic costs: KES 355000/- (Inclusive of cost of

	purchasing solar pump)
Estimated returns	KES 550000/-
Gender issues and concerns in development, dissemination, adoption and scaling up	Solar irrigation is friendly to female gender compared to diesel or electric systems because they have low running and maintenance costs. It is modern technology that is attractive to the youth
Gender related opportunities	The systems are adaptable to different irrigation scenarios thus fitting to all genders.
VMG issues and concerns in development, dissemination, adoption and scaling up	VMGs may not afford the investment costs but will afford the operational and maintenance costs if assisted
VMG related opportunities	The technology can increase farm incomes of VMGs by more than 70% because of the very operation and low maintenance costs
<b>E: Case studies/profiles of success stories</b>	
Success stories	Solar-powered Irrigation: Study of Ingotse Village, Kakamega County, Kenya Solar irrigation success stories have been reported in Counties such as Kajiado on high value crops
Application guidelines for users	Simon Ndogo Ndung’u, Tabitha Anyango Omoga and Nancy Masakha Angote 2016. Solar-powered Irrigation: Study of Ingotse Village, Kakamega County, Kenya, CTA working paper 16/10   June 2016
<b>F: Status of TIMP readiness</b> (1=Ready for up scaling; 2=Requires validation; 3=Requires further research)	2 =Requires validation
<b>G: Contacts</b>	
Contacts	Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI. Tel: +254-020-2464435 Ext. 300 E-mail: cd.narl@kalro.org
Lead organization and scientists	KALRO; I. V. Sijali, M. P. O. Radiro, F. Karanja, F. Kaburu
Partner organizations	Solar irrigation systems suppliers County governments National Irrigation Acceleration Programme (NIAP)


### Research Gaps

Validation of the solar irrigation systems in the different Counties.

Up scaling of the technology to smallholder community schemes

Solar irrigation systems that maximize crop water productivity

<b>2.4.8 TIMP Name</b>	<b>Drip irrigation</b>
Category (i.e. technology, innovation or management practice)	Management practices
<b>A: Description of the technology, innovation or management practice</b>	

Problem addressed	Water stress in open field tomato cultivation
What is it? (TIMP description)	<p>The management practice details the drip irrigation mode for tomato crop. Drip laterals should be placed at the center of the planting bed/row. In-line drip lateral should have an emitting point for every 30 cm interval with a discharge of 2 litres of water per hour. The frequency of irrigation is dependent on prevalent weather, soil type and stage of crop but should be set to ensure the plants are well watered throughout crop growth cycle.</p> 
Justification	<p>Tomatoes require good amounts of water during the growing period and fruit setting. Drip irrigation systems provides consistent water supply to the plants that leads to uniform maturity. Inadequate knowledge on use of irrigation techniques is a constraint in tomato cultivation. In dry weather regular watering is essential. Drip irrigation systems have superior attributes over other conventional irrigation methods in tomato cultivation owing to precise and direct application of water in the root zone. Farmers growing tomatoes under rain-fed conditions can save in water and fertilizer use besides increased growth, development and yield of tomatoes by use of drip irrigation. Drip irrigation is the most efficient and risk free method as it does not form water splashes on to plants hence reducing disease spread. There is need to train farmers on efficient water use through drip irrigation, use of clean water and water harvesting methods. Various drip systems require validation for their efficiency in target areas for increased tomato yields.</p>
<b>B: Assessment of dissemination and scaling up /out approaches</b>	
Users of TIMP	Farmers, extension service providers
Approaches used in dissemination	Farmer trainings, Farmer participatory demonstrations, Farmer field schools

Critical/essential factors for successful promotion	Water access Awareness creation Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and roles	County Government - to provide extension services and funding; Seed companies - to provide improved certified seeds and varieties; Individual farmers - to grow and sell tomatoes; Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers- to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Counties where already promoted	Major tomato growing counties such as Kirinyaga and Kajiado
Counties where TIMPS should be up scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in dissemination	Affordability, awareness and water access
Suggestions for addressing the challenge	Working with partners to offer financing and subsidies, sensitization of farmers on water harvesting and benefits of the systems.
Lessons learnt in upscaling if any	Demonstrations and Farmer participatory approach are key to adoption of recommendations
Social, environmental, policy and market conditions necessary for up scaling	Drip irrigation kits should be subsidized in cost so that they can be affordable for ordinary farmers
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 350,000 as total cost of production including drip kits for one acre cost of Drip irrigation is KES 170,000/-
Estimated returns	KES 750,000 per acre per season of Raja Tomato variety
Gender issues and concerns in development, dissemination, adoption and scaling up	Drip irrigation has no drudgery effect and can be easily utilized by all gender categories  Capital cost of installing drip system may be prohibitive for some gender categories

Gender related opportunities	All gender categories can easily utilize drip irrigation system in tomato production. The system uses water efficiently and requires less labour. Since the system is self-propelling, one is not tied up on-farm all day long and for women in particular, this is advantageous as they can simultaneously attend to other domestic roles
VMG issues and concerns in development, dissemination, adoption and scaling up	- Drip irrigation has no drudgery effect and can be easily utilized by all VMGs  Capital cost of installing drip system may be prohibitive for some VMGs
VMG related opportunities	- VMGs can easily operate drip irrigation system in tomato production. The system uses water efficiently and requires less labour. Since the system is self-propelling, one is not tied up on-farm all day long and allows for rest periods for the VMGs
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Two Kisii farmers (Onyancha and Sang’anyi) are anticipating to earn more than Sh750, 000 a month from their one acre farm after planting tomatoes in December 26th 2017 to January 2nd 2018, using drip irrigation system targeting the off-season mid-March market when the produce prices are high in the country
Application guidelines for users	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
<b>F. Status of TIMPS readiness</b> 1) Ready for up scaling; 2) Requires validation; 3) Requires further research	2) Requires validation
<b>G. Contacts</b>	
Contacts	Centre Director KALRO Kabete, off Waiyaki way, P.O. Box 14733-00800, NAIROBI.  Tel: +254-020-2464435 Ext. 300  E-mail: cd.narl@kalro.org

Lead organization and scientists	KALRO Isiah Sijali, Rahab Magoti Agnes Ndegwa Rebecca Faraay
Partner organizations	MoALF&C, Agro-preneurs

### Gap

1. Demonstration of the technology in target areas

<b>2.4.9 TIMP name</b>	<b>Styrofoam based intensive tomato production</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Growing tomatoes in soil faces many challenges especially the soil borne Bacterial wilt ( <i>Pseudomonas solanacearum</i> ) and nematodes. Soilless systems offer opportunities for dealing with this problem. However, limited containers are available to be used with non-soil substrates.
What is it? (TIMP description)	Styrofoam boxes are used to hold soilless substrate (coco-peat) in which tomatoes are grown. The Styrofoam boxes are available on the Kenyan market for packaging of fragile equipment during transportation. The boxes have been adopted for growing tomatoes. Each box measures 355mm x 260mm x 155mm with 10 litres capacity. Each box is planted with 4 tomatoes plants that grow to maturity. The system is equipped with drip irrigation to provide water or nutrient solution. The system uses substantially little amounts of substrate which reduces the cost of media used in the system. This also makes it possible to sterile media for reuse.
Justification	The system allows the use of soilless substrate such as cocopeat in growing high quality tomatoes. It helps to overcome problems associated with soil borne diseases and other production challenges. Styrofoam is a light weight material and has insulating capacity which moderates root-zone temperature for stable tomato growth. The boxes are readily available on the Kenya market and require only minor modification for use.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato growers, extensions staff, consultants
Approaches to be used in dissemination	Newspapers and magazines, ASK shows, Trade fairs, TV, Youtube

Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Validation through on farm trials with participation of farmers
Partners/stakeholders for scaling up and their roles	County Government - to provide extension services and funding; Agro-dealers - to provide agro inputs Individual farmers - to grow and sell tomatoes; Farmer groups/CBOs - to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers- to provide viable all year round markets at good prices that spur growth of the crop, Student interns, African Farmers Club to spur youth start-up ventures
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Kiambu-(JKUAT)
Counties where TIMP will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya,
Challenges in dissemination	None known
Suggestions for addressing the challenges	N/A
Lessons learnt in upscaling, if any	N/A
Social, environmental, policy and market conditions necessary for development and upsaling	None
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KSh 185 per box (KSh. 88,800 for 240sq.m. greenhouse, computed as 40 rows of 12 boxes = 480 boxes @ KSh. 185)
Estimated returns	KSh. 1,920,000 per 240sq.m greenhouse (480 boxes x 4 plants per box x KSh. 250 per plant)
Gender issues and concerns in development, dissemination, adoption and scaling up	None. Technology can apply to either gender
Gender related opportunities	Due to high value and per unit productivity, it is a good avenue for empowering women and the youth.

VMG issues and concerns in development, dissemination, adoption and scaling up	High initial costs may limit adoption by VMGs
VMG related opportunities	Due to high value and per unit productivity, it is a good avenue for empowering women and the youth.
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Styrofoam boxes have been used at JKUAT to grow cherry tomatoes. High productivity and high quality produce was achieved with good returns
Application guidelines for users	Resource materials to be developed.
<b>F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research</b>	<b>2. Requires validation</b>
<b>G: Contacts</b>	
Contacts	Jomo Kenyatta University of Agriculture and Technology (JKUAT), Department of Horticulture and Food Security
Lead organization and scientists	JKUAT, John M. Wesonga, Urbanus Mutwiwa
Partner organizations	Wago Company Limited and IMG Co. Ltd, Japan

### Research Gaps

1. Undertake cost benefit analysis of the technology
2. Assess performance of technology at farm level

<b>2.4.10 TIMP name</b>	<b>Capillary wick based irrigation system</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	With climate change, water for growing horticultural crops including tomatoes is becoming limited. Efficient low costs irrigation methods are required for crop production under the changing climate
What is it? (TIMP description)	<ul style="list-style-type: none"> <li>• Capillary wick irrigation involves the use of a device that delivers water by capillary movement from a reservoir to the plant growing medium</li> </ul>

	<ul style="list-style-type: none"> <li>• The system has a compartment for holding plant growing substrates. The system may be made of locally available material such as timber or plastic containers.</li> <li>• The compartment has provision through which wick materials pass through from inside to a water reservoir.</li> <li>• The system has a water reservoir which may be of any locally available materials such as waste pipes or gutters. The water reservoir is maintained full during the growing period</li> <li>• Various growing substrates including soil, cocopeat and mixtures may be used</li> <li>• A capillary wick of a suitable material and dimensions runs from the substrate compartment to the water reservoir</li> <li>• The system is modular allowing starting small and expanding on need and capacity</li> <li>• Initial system costs KSh 10,000 per module with 32 plant capacity</li> </ul>
Justification	The technology has potential to enhance crop production and contribute to food security under the changing climate. This innovative method is easy and cheap to install and operate making it particularly suitable for resource poor farmers in Kenya. The system saves upto 63% water compared to bucket irrigation.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Growers of high quality horticultural growers, service providers involved in greenhouse construction, the youth and youth led enterprises
Approaches to be used in dissemination	Newspapers and magazines, ASK shows, Trade fairs, TV, social media e.g. Youtube
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Validation through on farm trials with participation of farmers
Partners/stakeholders for scaling up and their roles	Service providers: County extension staff for collaboration in technology demonstration and dissemination, Media for awareness creation, student interns for installation and adaptation to local situations
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Limited

Counties where TIMP will be upscaled	Kiambu, Machakos
Challenges in dissemination	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya,
Suggestions for addressing the challenges	None
Lessons learnt in upscaling, if any	N/A
Social, environmental, policy and market conditions necessary for development and upsaling	N/A
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KSh 10,000 per system (KSh 400,000 per 240sq.m greenhouse)
Estimated returns	KSh. 23,040.00 pers system (KSh. 921,600.00 per 240sq.m greenhouse per production cycle)
Gender issues and concerns in development, dissemination, adoption and scaling up	It is suitable for both gender and highly attractive to the youth. It provides very conducive working environment
Gender related opportunities	It can promote engagement of women and the youth to farming
VMG issues and concerns in development, dissemination, adoption and scaling up	No known issues to date
VMG related opportunities	<ul style="list-style-type: none"> <li>- VMGs are accommodated and can benefit if included in the dissemination and scaling up</li> <li>- It is relatively cheap and modular hence can address the issue of marginalized persons</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Capillary wick system has been installed by Mr. Bakari of Roben Center in Mukuru kwa Njanga. He installed some units in Somali and Kakuma refugee camp. The system was able to sustain vegetable production using limited water in extremely dry condition. Mr. Larry Mwendwa a student at JKUAT has installed the system in some farmers field in Machakos county. Mr. Caleb Ndolo has applied the system for vegetable production

Application guidelines for users	Manual to be provided upon validation
<b>F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research</b>	<b>2. Requires validation</b>
<b>G: Contacts</b>	
Contacts	Jomo Kenyatta University of Agriculture and Technology (JKUAT), Department of Horticulture and Food Security
Lead organization and scientists	JKUAT, John M. Wesonga, Martin Mburu, Patrick Home. Mr. Francis Ombwara, Cornelius Wainaina, Larry Mwendwa, Caleb Ndolo
Partner organizations	Ruben Centre <a href="https://www.rubencentre.org">https://www.rubencentre.org</a> . (Mr. Bakari), Vintage green, KALRO

### Research Gaps

1. Optimization of fertilizers for use with capillary wick system especially development of slow-release fertilizers or liquid fertilizers
2. Develop mechanisms for controlling algae in the systems
3. Assess performance of the system with farmers in different localities and crops
4. Assess other local materials for adaptation of the system to local situations
5. Develop installation and operator's manual to support implementation

## 2.5 Management of Physiological Disorders


<p><b>2.5.1.TIMP Name</b></p>	<p><b>Management of blossom End Rot</b></p>  <p><b>Photo source; Abel Too, KALRO</b></p>
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Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low tomato productivity due to physiological disorders caused by a localized deficiency of calcium in the distal (blossom) end of the fruit due to fluctuation in water supply even for a short period of time.
What is it? (TIMP description)	The mitigation measure entails adequate calcium supply to the crop root zone by application of calcium in fertigation or spray with 0.5% CaSO <sub>4</sub> solution and maintaining watering balance to the tomato crop to maintain steady fruit and plant growth.
Justification	Farmers lack information on importance of regular watering and balanced nutrition of tomatoes. Blossom end rot cannot be reversed in a tomato fruit once it has set in. However, under good management practices the problem can be prevented to increase on tomato production and improve crop resilience to cope with other environmental hazards such as drought. Blossom end rot is of economic importance and can cause up to 30% crop losses in tomato production systems.
<b>B: Assessment of dissemination and scaling up /out approaches</b>	
Users of TIMP	
Approaches used in dissemination	Farmer trainings, Farmer participatory demonstrations, Farmer field schools
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Evidence for market demand or market surveys</li> <li>• Timely and availability of planting materials</li> <li>• Training of trainers and other lead farmers</li> </ul>
Partners/stakeholders for scaling up and roles	County Government - to provide extension services and funding; Seed companies - to provide improved certified seeds and varieties; Individual farmers - to grow and sell tomatoes; Farmer groups/CBOs - to link farmers with other

	stakeholders, source for inputs jointly and seek market outlets; Marketers - to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Counties where already promoted	Kirinyaga, Embu, Meru, Kajiado, Tharaka-Nithi, Busia, Makueni, Bungoma, Taita Taveta, Makueni, Tranzoia, Busia, Uasin Gishu, Machakos,
Counties where TIMPS should be up scaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya,
Challenges in dissemination	Inadequate/unavailability of soil sampling and testing services to determine the mineral availability  High cost and inadequate funds to purchase planting materials
Suggestions for addressing the challenge	N/A
Lessons learnt in up-scaling if any	Practical demonstrations aid in promoting adoption of management practices
Social, environmental, policy and market conditions necessary for up-scaling	<ul style="list-style-type: none"> <li>• Awareness of the benefits/advantages/management of the technology to enhance acceptability for increased up take.</li> <li>• Availability of domestic and international markets for the commodity.</li> <li>• Enabling policy frameworks</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The estimated capital input is KES. 3,500 per acre, Purchase of Knapsack sprayer at KES. 10,000 and KES. 4000 for labour per acre for the all season. Total basic costs is 7500
Estimated returns	Potential yields of 18000kgs per acre per season of tomato is under good agronomic practices. Integrated blossom end rot management contributes 30% increase in yield @ KES. 49/ kg.  Estimated returns of KES. 216,000 per acre per season
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> <li>• Blossom end rot may be expensive for women, youth and en when it comes to purchase of calcium related fertilizers and applications it may require additional time</li> <li>• Women have limited access to agricultural and extension services hence might not be aware of the blossom end rot disorder that lower productivity</li> </ul>

Gender related opportunities	In implementing the management of the Blossom end rot, there is increased productivity 3 fold in terms of the household incomes.
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> <li>• VMGs face the barrier of accessing clean planting materials of the varieties due to inadequate resources such as land and credit</li> <li>• Due to prejudices associated with their social status, VMGs find it difficult to access improved technologies</li> </ul>
VMG related opportunities	- All VMGs can participate in management of blossom end rot
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	- Previous initiatives under NACOSTI project in Kirinyaga and Muranga Counties sensitized farmers on management of blossom end rot
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guide on tomato staking and pruning documented
<b>F. Status of TIMPS readiness</b> 1) Ready for up scaling; 2) Requires validation; 3) Requires further research	Requires validation
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO- Agnes Ndegwa Rahab Magoti, Charity Gathambiri, and Finyage Pole
Partner organizations	MoALF, JKUAT, Agro-dealers

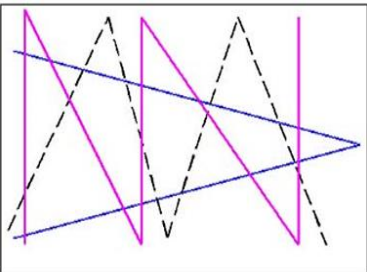
<b>2.5.2.TIMP Name</b>	<b>Shade-net tomato cultivation for management of sunscald</b>
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	 <p>Sun scald on tomato fruit. Photo source; Abel Too, KALRO</p>
<p>Category (i.e. technology, innovation or management practice)</p>	<p>Technology</p>
<p><b>A: Description of the technology, innovation or management practice</b></p>	
<p>Problem addressed</p>	<p>Yield loss through sun scald that lowers the marketability and quality of tomatoes.</p>
<p>What is it? (TIMP description)</p>	<p>The shade materials help in protecting plants, from direct sunlight and also works as a windscreen during the dry periods. Depending on the climatic conditions shade net of 50% to 60% density should be used by tomato growers in cooler areas while in hotter it should be 70-80%.</p>
<p>Justification</p>	<p>Use of shade net is a climate smart technology ensures that tomato fruit remains free from scalding when temperatures are very high. Sun scald causes about 50% crop and yield losses. Use of the shade nets create the microclimate and influences growth of plants. The plants are also protected from wind pressure damage and photosynthesis is enhanced to stimulate plant growth. The shade net also promotes retention of flowers during the dry spell in hot areas that would otherwise abort resulting in reduced yields. Growing tomatoes under shade nets can increase the yield and improve the quality of tomatoes. The technology requires validation in target areas.</p>
<p><b>B: Assessment of dissemination and scaling up /out approaches</b></p>	
<p>Users of TIMP</p>	<p>Farmers, Extension service providers, agro-prenuers operators</p>
<p>Approaches used in dissemination</p>	<p>Farmer trainings, Farmer participatory demonstrations, Farmer field schools</p>

Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and roles	County Government - to provide extension services and funding; Seed Companies - to provide improved certified seeds and varieties; Individual farmers - to grow and sell tomatoes; Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers - to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Counties where already promoted	Not validated by KALRO but some farmers are practicing the technology in some Counties such as Meru
Counties where TIMPS should be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Inadequate/unavailability of Shade nets</li> <li>• High cost and inadequate funds to purchase shade nets</li> </ul>
Suggestions for addressing the challenge	<ul style="list-style-type: none"> <li>• Lower the cost of shade nets</li> <li>• Collaboration with county government in supply of shade nets in bulk to small scale farmers</li> <li>• Capacity building of farmers and service providers in Tomato value chain on importance of shading technology</li> </ul>
Lessons learnt in upscaling if any	None
Social, environmental, policy and market conditions necessary for upscaling	All gender categories can participate in shade-house tomato management practices
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The cost of acquiring shade nets for 1 acre KES. 24,500 and pegs to suspend the net at KES. 10,000. The labour @ KES. 5,000
Estimated returns	Potential yields of 18000kgs per acre per season is expected under good agronomic practices. Integrated shade net management contributes 50% increase in yield @ KES. 40/kg.  Estimated returns of KES. 360,000 per acre per season

Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Technology practical for men, women, youth</li> <li>- Establishment of the shade net structure has cost implications that may be prohibitive for some gender categories</li> </ul>
Gender related opportunities	All gender categories can practice technology
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> <li>- Technology practical for VMGs</li> <li>- Establishment of the shade net structure has cost implications that may be prohibitive for some VMGs</li> </ul>
VMG related opportunities	VMGs can practise technology if issues of concern are addressed
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Meru farmers group in Meru County
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guide on management of sun-scald in tomato are documented
<b>F. Status of TIMPS readiness</b> 1) Ready for up scaling; 2) Requires validation; 3) Requires further research	Requires validation;
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO Agnes Ndegwa Rahab Magoti, Charity Gathambitri, John Wesonga , Finyange Pole
Partner organizations	MoALF, JKUAT

## 2.6 Pests and Diseases

<b>2.6.1 TIMP Name</b>	<b>Scouting for pests identification and control</b> 
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Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Limited awareness by farmers on the need to undertake scouting for pest attack in their fields
What is it? (TIMP description)	Scouting techniques and frequency to determine the presence of the different types of pests and their respective populations in order to make a decision on the control measures to be undertaken.
Justification	Most farmers spray pesticides indiscriminately in tomato crops. This is not only uneconomical but also destructive to the environment and at the same time kills the beneficial insects. Scouting involves regular monitoring the incidences of pest damage to crops. The purpose is to gain a good understanding of insect pests, diseases, weed and beneficial insect activity in your crop. Effective monitoring includes assessing the numbers of insect pests as well as the beneficial insects in a crop together with the incidences of diseases and weeds. Recording this information and any control actions taken, will help to better understand your crop management practices over time. Scouting has to be done on a regular basis so that appropriate remedial measures are undertaken timely hence reducing crop losses by 15% as well as saving on the costs of pesticides.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension service providers, agropreneurs
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favor of current practices maybe difficult to achieve
Suggestions in addressing the challenges	-Capacity building and sensitization forums

	-Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness and benefits of scouting.
Lessons learnt in up scaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized group dynamics to emphasis and practice the benefits of scouting
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Basic cost of undertaking the scouting is estimated at KES. 5,000 per acre per season
Estimated returns	Potential yields of 18000kgs per acre per season is expected under good agronomic practices. Integrated shade net management contributes 15% increase in yield @ KES. 40/kg. Estimated returns of KES. 108,000 per acre per season
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women have limited access to agricultural and extension services hence might not be aware of the scouting techniques</li> <li>• There is need for an inclusive extension strategy targeting men, women and youth during dissemination and up scaling meetings for more awareness of scouting techniques</li> </ul>
Gender related opportunities	All gender categories can participate in tomato field scouting which has potential to increased yields and quality fruits thus reducing production costs
VMG issues and concerns in development, dissemination, adoption and scaling up	The VMG can easily participate in crop scouting once sensitized
VMG related opportunities	Scouting for tomato pests and diseases can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
<b>E: Case studies/profiles of success stories</b>	
Success stories	Farmers who were sensitized in the FARM-Africa funded Passion fruit project in coastal Kenya are undertaking scouting as a management practice. Some framers growing tomatoes have embraced the practice in this region.
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop health management are documented
Status of TIMP (1. ready for up scaling 2, Requires validation 3. Requires further research)	1. Ready for up scaling
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, KU and JKUAT
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&C, County governments, Universities (KU and JKUAT)



<b>2.6.2 TIMP Name</b>	<b>Integrated Pest Management practices for pest management</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Excessive use of pesticides for the control of insect pests in open fields and greenhouses for tomatoes is reaching alarming levels. Other farmers have gone to an extent of using non-crop chemicals such as acaricides that are used for tick control to control pests in tomatoes. This exposes the consumers of tomato to a great health risk.
What is it? (TIMP description)	Integrated pest Management (IPM) practice involves the use of a combination of biological, cultural, mechanical, host plant resistance and chemical control practices for the management of pests in tomato fields. In IPM practices, the use of agro-chemicals is usually considered as a last option after undertaking all the other pest control practices and realizing that the pests are still attacking the crop.
Justification	There has been an upward trend in the use of pesticides for the control of various pests in tomatoes. Once farmers spray their crop with either a pesticide or fungicide, there is usually a pre-harvest interval (PHI) that must be observed before the crop is harvested. This condition is hardly observed by farmers hence most of the produce reaching the consumers has high chemical residues which is a health hazard. Adoption of IPM practices for control of pests in the fields and greenhouses will not only reduce the costs for purchase of pesticides but will also make the final produce safe for consumption and increase yield by 80%. The IPM strategy involve the use of a multiple control practices such as cultural control, mechanical, biological, botanicals and use of chemicals is considered as the last option
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	

Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve
Suggestions in addressing the challenges	<ul style="list-style-type: none"> <li>• Capacity building and sensitization forums</li> <li>• Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness _</li> </ul>
Lessons learnt	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The basic cost of undertaking IPM package for tomato production per acre per season is estimated at KES. 150,000
Estimated returns	The potential expected yields per acre per season under good agricultural practices is approximately 18,000kgs. Use of IPM management increases yield by 80% equivalent to 14,400kg @ KES. 40/kg
Gender issues and concerns in development, dissemination, adoption and scaling up	Technology basically gender friendly. It can easily be adopted by women, youths and the physically challenged
Gender related opportunities	All gender categories can participate in tomato IPM technology which has potential to increased yields of quality fruits and reduction in costs
VMG issues and concerns in development, dissemination, adoption and scaling up	The VMG can easily participate in crop IPM technology once sensitized
VMG related opportunities	IPM for tomato pests and diseases can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
<b>E: Case studies/profiles of success stories</b>	
Success stories	Farmers who were sensitized in the FARM-Africa funded Passionfruit project in coastal Kenya are undertaking IPM as a management practice and this has influenced them to practice the same in tomato cultivation. Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas who practice IPM
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on IPM in tomato are documented
Status of TIMP (1. ready for up scaling 2. Requires validation 3. Requires further research)	Requires validation
<b>F: Contacts</b>	

Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, KU and JKUAT
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&C, County governments, Universities (KU and JKUAT)


### **Research Gaps**

1. Validation of the IPM technology in different agro-ecological zones in order to come up with region specific management practices
2. Validation of use of agri-nets for management of pests in tomato

<p><b>2.6.3 TIMP Name</b></p>	<p><b>Integrated management of soil pests (Cut worms, <i>Agrotis</i> spp and Chafer grubs, <i>Melolontha</i> spp)</b></p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Cutworm                      Chafer grub Photo source; Vincent Ochieng</p>
<p>Category (i.e. technology, innovation or management practice)</p>	<p>Management practice</p>
<p><b>A: Description of the technology, innovation or management practice</b></p>	
<p>Problem addressed</p>	<p>The major soil pests attacking tomato seedlings are cut worms, <i>Agrotis</i> spp and chafer grubs, <i>Melolontha</i> spp that contribute to low tomato productivity. Cut worm larvae are grey to black caterpillars approximately 24 mm long often found hidden in the soil near the seedlings. They hide in the soil feeding on the underground parts of the plant during the day and come to the surface to feed on the aerial parts of the plant at night. Soil pest infestations are sporadic and are more common in weedy spots, fields with high organic matter and poor drainage.</p>
<p>What is it? (TIMP description)</p>	<p>Integrated control practice for tomato soil pests involves the use of a combination of biological, cultural, and chemical control methods in the tomato fields. The use of one control method alone is not effective since the pest usually buries itself underground and start feeding on the roots during the day and comes out at night to feed on the aerial parts. Cultural methods include clearing the fields of weeds and other foreign materials before application of other control measures. Biological control with bio-pesticides such as <i>Bacillus thuringiensis</i> may be used to control the pests. If the two methods are found to be ineffective, then the chemical control method could be used by application the following chemicals: Dusting around the plant after transplanting preferably in the afternoon with Dipterex (Dylox) Trichorphon 5% dust similarly at 2 kg/ha and add baits e.g. Bran mixed with sugar or Spray with pyrethroid insecticides at transplanting.</p>
<p>Justification</p>	<p>Cutworms and chaffer grubs normally cut the seedlings stem at the soil line, and eat holes into roots. The injured plant thereafter, withers and die. Young caterpillars feed on the leaves leaving perforations on the leaves. The pests feed on the plants at the base causing serious damage to stems. Stalks of plants may be cut. Soil pest infestations are sporadic and often associated with sections of the field that are weedy, have high amounts of organic</p>


	residue, or poor drainage. Integrated Management of the pests using cultural, biological as well as chemical options is critical to ensure optimum plant population and to achieve expected yields. Adoption of IPM in management of soil borne pest lead to 20% increase in yield.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension service providers, agropreneurs
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of recommended practices maybe difficult to achieve
Suggestions for addressing the challenges	-Capacity building and sensitization forums -Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness
Lessons learnt in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The cost of implementing IPM for cutworms and the chaffer grubs for 1 acre KES. 10,000 for inputs and labour @ KES. 5,000. (Total cost KES 15,000) per acre per season.
Estimated returns	Potential yields of 18000kgs per acre per season of tomato is under good agronomic practices. Integrated soil borne pest management contributes 20% increase in yield @ KES. 40/ kg. Estimated returns of KES.144,000 per acre per season
Gender issues and concerns in development, dissemination, adoption and scaling up	The practice can easily be adopted by women, youths and the physically challenged

Gender related opportunities	All gender categories can participate in integrated management of soil pests in tomato which has potential to increase yields and quality of tomato fruits and reduction in costs
VMG issues and concerns in development and dissemination	The VMGs can easily participate in Integrated cutworm control technology once sensitized
VMG related opportunities	Integrated control of soil pests practice can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
<b>E: Case studies/profiles of success stories</b>	
Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection
Status of TIMP (1. ready for up scaling 2, Requires validation 3. Requires further research)	Ready for up scaling
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, KU and JKUAT
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&C, County governments, Universities (KU and JKUAT)

<b>2.6.4 TIMP Name</b>	<p><b>Management of Whiteflies by use of integrated control practices</b></p>  <p>(a) Tomato leaf infested by whiteflies and (b) close-up of the whiteflies</p>
<b>Category (i.e. technology, innovation or management practice)</b>	<b>Management practice</b>
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	There are two very important whitefly pests of vegetables including tomatoes. These are: the greenhouse whitefly ( <i>Trialeurodes vaporariorum</i> ) and sweet potato whitefly B-biotype ( <i>Bemisia tabaci</i> ). The nymphs and adults pierce and-suck plant fluids. Infestation result in yellowing of


	leaves (due to the sap extraction). Heavy infestation is characterized by presence of black sooty mould (fungi), which grows on the honeydew (sugary sap) excreted by the nymphs. This sooty mould reduces photosynthesis increasing the damage problems. Leaf fall is common under heavy infestation leading to crop losses of up to 60% thus lowering productivity by same quantity.
What is it? (TIMP description)	<p>Integrated control practice for whiteflies involves the use of a combination of biological, natural enemies and chemical control methods in the tomato fields. The use of one control method alone is not effective. The use of chemicals for example leads to the development of resistance. This calls for an integrated approach aimed at reducing the damage caused by whiteflies in the farmers' fields. Among the control practices recommended include:</p> <p><b>Natural enemies:</b> <i>Encarsia formosa</i> is a tiny parasitic wasp of <i>B. tabaci</i>, in which case the parasitized larvae becomes transparent to brown in color. Another tiny wasp, <i>Eretmocerus</i> spp. parasitizes <i>B. tabaci</i>.</p> <p><b>Bio-pesticides:</b> Apply neem products at a recommended rate. Chemical control. The pest is easily controlled using pesticides such as Brigade. It is important to completely cover the underside of the leaves with the pesticide being applied. High concentrations of the chemicals may injure the crop, hence it is important to use small doses in combination with the other control methods.</p>
Justification	Whiteflies are known to quickly develop resistance to many pesticides and therefore IPM is very necessary against this pest. Their sap sucking activity may result in wilting and leaf malformation. The adults fly away from the leaf once the foliage is disturbed. The nymphs suck plant sap from the underside of the leaf. This can be a serious problem especially in hot areas if not addresses early enough. The insect is a vector of cassava mosaic virus, cotton leaf curl, tobacco leaf curl and sweet potato virus B, hence the need to control it.
Region promoted	Kirinyaga, Kajiado and Elgeiyo- Marakwet
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer


	mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Change of mindset in favor of current practices maybe difficult to achieve due to quick fix simple methods such as chemical application.</li> <li>• Integrated pest resistance build up</li> </ul>
Suggestions for addressing the challenges	Capacity building and sensitization forums Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness
Lessons learnt in upscaling if any	Farmer participatory approach such as field demonstrations and farmer to farmer visits.
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The cost of implementing IPM for cu worms and the chaffer grubs for 1 acre KES. 10,000 for inputs and labour @ KES. 5,000. (Total cost KES 15,000) per acre per season.
Estimated returns	Potential yields of 18,000kgs per acre per season of tomato is under good agronomic practices. Integrated pest management of whiteflies contributes 60% increase in yield @ KES. 40/ kg. Estimated returns of KES.288,000 per acre per season when white flies IPM is adopted
Gender issues and concerns in development and dissemination	Technology basically gender friendly. It can easily be adopted by women, youths and the physically challenged
Gender issues and concerns in adoption and scaling up	Youth and women spend much time and labor engaging in the whiteflies management through scouting, pruning, and monitoring for spray application.
Gender related opportunities	All gender categories can participate in tomato whiteflies IPM technology which has potential to increase yields and quality of fruits to lower the cost of production. Youth can form spray teams for livelihood generation.
VMG issues and concerns in development and dissemination	The VMG can easily participate in Integrated whiteflies control technology once sensitized
VMG issues and concerns in adoption and scaling up	None
VMG related opportunities	Integrated whitefly control practice can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
<b>E: Case studies/profiles of success stories</b>	
Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas

Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection
Status of TIMP (1. ready for up scaling 2, Requires validation 3. Requires further research)	Ready for up scaling
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, KU and JKUAT
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&C, County governments, Universities (KU and JKUAT)
<b>2.6.5 TIMP Name</b>	<b>Integrated management of African bollworm, <i>Helicoverpa armigera</i> Hb.</b>   <p>African Bollworm damage (a) on immature and (b) mature fruits</p>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	The caterpillars of the African bollworm are major pests of tomato. They bore into the fruit often with the hind part of the body exposed outside causing crop losses and negatively influencing the productivity. They produce copious amounts of pellet-like droppings. One caterpillar can cause damage to several plant parts such as flowers, flower buds and fruits which are characterized by presence of one or two rounded holes thereby making the tomato farmer incur heavy losses of up to 90%.
What is it? (TIMP description)	Integrated control practice for tomato African bollworm involves the use of a combination of biological, cultural, natural enemies and chemical control methods in the tomato fields. The use of one control method alone is not effective. The use of chemicals for example leads to the development of resistance. This calls for an integrated approach aimed at

	reducing the damage caused by African bollworm in the farmers' fields.
Justification	The African bollworm is one of the major pests of economic importance in tomatoes. It can cause field losses of up to 90% as the pest has the potential to multiply very fast. The most destructive stage is the larvae and hence an integrated approach for its control is very essential. Scouting of the crop for the pest on regular basis should be encouraged so as to reduce losses and increase productivity.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/farmer field schools, shows, trade fairs, posters and flyers
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, individual Farmers, farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Capacity building and sensitization forums</li> <li>• Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness</li> </ul>
Lessons learnt in upscaling if any	Previous research initiatives have shown that Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The cost of implementing IPM bollworms for 1 acre KES. 10,000 for inputs and labour @ KES. 5,000. (Total cost KES 15,000) per acre per season.
Estimated returns	Potential yields of 18,000kgs per acre per season of tomato is under good agronomic practices. Integrated pest management of bollworms contributes 90% increase in yield @ KES. 40/ kg. Estimated returns of KES.648,000 per acre per season when boll worm IPM is adopted



Gender issues and concerns in development, dissemination, adoption and scaling up	The management practice can easily be adopted by all gender categories
Gender related opportunities	All gender categories can participate in tomato IPM technology which has potential to increased yields of quality fruits and reduction in costs
VMG issues and concerns in development and dissemination	The VMG can easily apply the management practice once sensitized
VMG related opportunities	Integrated African bollworm control practice can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
<b>E: Case studies/profiles of success stories</b>	
Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas and are practicing integrated management of tomato soil pests
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection
Status of TIMP (1. ready for up scaling 2, Requires validation 3. Requires further research)	Ready for up scaling
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, KU and JKUAT
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&C, County governments, Universities (KU and JKUAT)

<b>2.6.6 TIMP Name</b>	<p><b>Integrated management of Red spider mites, <i>Tetranychus spp.</i></b></p>  <p>Adult Red spider mite species</p>
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	 <p>Red spider mites damage on the tomato leaves. Photo source; V. Ochieng, KALRO</p>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<p>Low productivity due to spider mites attack. Red spider mites pose a major problem on tomato and other members of the Solanaceae (eggplant, chillies, capsicums and Irish potato) family. The pest attacks many cultivated and wild plants, has a high reproductive capacity and can destroy plants within a short period of time. When left uncontrolled the farmer can lose his entire production within a week. The mites can be spread by the wind. Infestation often starts on the outside (border rows) of a plot. Therefore, other adjacent (tomato) crops, wild plants and weeds can serve as a source of infestation. Mites can also be spread passively by irrigation water, dust storms, clothing and implements. All the different stages of insect development are usually found together on the leaves at the same time. The pest develops very rapidly in warm, dry weather and could be among the pests that show resurgence due to adverse effects of climate change.</p>
What is it? (TIMP description)	<p>Integrated control practice for red spider mites in tomato involves the use of a combination of biological, natural enemies and chemical control methods. This is so because the pest has a large range of host plants and can easily be spread by agents such as wind, irrigation water, dust storms and even clothes. To ensure an effective control of the pest, there is need to use IPM technologies. These include:</p> <p><b>Cultural practices.</b> Regular scouting of the crop to determine the presence of the pest and the level of infestation at an early stage is a substantial element of IPM (Integrated Pest management). Burning of infested plants can be successful during the early stages of infestation when the mites concentrate on a few plants. The separation of infected crops and newly planted crops or nursery areas and the burning or removal of infected crop residues and weeds, also helps to minimize the problem. Natural enemies such as predatory mites are effective in the control of spider mites. e.g.</p>

	<p><i>Phytoseilus persimilis</i> has been very effective when used in the green house;</p> <p><b>Botanical pesticides:</b> Botanicals such as Neem (<i>Azadirachta indica</i>) and <i>Tephrosia</i> sp. are currently being evaluated in Kenya for their effectiveness in the control of red spider mite.</p> <p><b>Chemical control:</b> Curative and preventive treatments especially during the vegetative phase are advisable. Effective insecticides include Abamectin, Amitraz, Dicofol, Clofentezine, Bifenthrin, Tetradifon and Azadirachtin among others. Care should be taken when considering chemical control (contact extension staff or KALRO for advice) for information available chemical formulas and their cost-effectiveness.</p>
Justification	<p>The Red spider mites are serious pests that cause damage to the leaves by injuring as a result of the sucking out of valuable substances from the underside of leaves causing speckling and tarnishing and eventual leaf fall. Under severe attacks they will cause stunted growth and reduce yields by at least 50%. The problem is more acute during dry weather spells. The mites and its webbing, just visible to the eye, can be seen on the underside of the leaf. Spider mites may also cause spots on the fruits. Because of their small size (0.3-0.5mm), an infestation is often only noticed after the leaves have been discolored. This calls for an integrated approach with effective scouting programmes in place to enable early detection for the pest in order to undertake appropriate control measures.</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension service providers
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers, farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	High cost and inadequate funds to undertake the integrated management systems


Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Collaboration with county government in supply of pest control products and personal protective clothing</li> <li>• Capacity building of farmers and service providers on integrated management of red spider mites</li> </ul>
Lessons learnt in upscaling if any	Farmer participatory approach
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The cost of implementing IPM red spider mites for 1 acre KES. 10,000 for inputs and labour @ KES. 5,000. (Total cost KES 15,000) per acre per season
Estimated returns	Potential yield of 18,000kgs per acre per season of tomato is under good agronomic practices. Integrated pest management of red spider mites contributes 50% (360,000) increase in yield @ KES. 40/ kg
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth lack funds to buy seed storage materials</li> <li>• Slow information and awareness flow to female farmers due to their low academic levels</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Empower the women and youth who want to produce tomato by connecting them to financial sources</li> <li>• The TIMP has the potential of increasing production, hence improved household food security</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	The VMG can easily participate in Integrated red spider mites control technology once sensitized
VMG related opportunities	Integrated red spider mite control practice can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
<b>E: Case studies/profiles of success stories</b>	
Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas and practice Integrated red spider mite control
Application guidelines for users	Posters, tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection
Status of TIMP (1. ready for up scaling 2, Requires validation 3. Requires further research)	Ready for up scaling
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, KU and JKUAT
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&C, County governments, Universities (KU and JKUAT)

<p><b>2.6.7 TIMP Name</b></p>	<p><b>Management of Tomato leaf miners (<i>Tuta absoluta</i> and <i>Liriomyza spp</i>) by use of integrated control practices</b></p>  <p>Blister on the tomato leaf caused by <i>Tuta absoluta</i>. Photo source; V. Ochieng</p>  <p>Tuta damage on tomato (a) leaves (and Tuta larvae-inset) and (b) fruit.</p>
<p>Category (i.e. technology, innovation or management practice)</p>	<p>Management practice</p>
<p><b>A: Description of the technology, innovation or management practice</b></p>	
<p>Problem addressed</p>	<p>Low yield due to <i>Tuta absoluta</i>. The adults <i>Liriomyza spp</i> are small black and yellow flies about 2mm long. They lay eggs which hatch into small larvae that feed by mining between the upper and lower epidermis of the leaves making a tunnel as they move along. On the other hand <i>Tuta absoluta</i> are caterpillars that are yellowish when newly hatched, later turn yellow green with a black band behind the head and the fully grown ones have a pinkish colour on their back <i>Tuta absoluta</i> is a devastating leaf miner on tomato crops. The pest can cause up to 50-100% yield reduction on tomato crops and its presence may also limit the export of the produce. It reproduces rapidly with a life cycle of 24-38 days, depending on the temperature, the minimum being 9° C. Damage by “mining” causes whitish blotches inside the leaves, kills the leaves eventually making them fall off prematurely.</p>
<p>What is it? (TIMP description)</p>	<p>Integrated control practice for leaf miners involves the use of a combination of biological, natural enemies,</p>

	traps, pheromones and chemical control methods in the tomato fields. The use of one control method alone is not effective. This is so because the pest has the ability to develop resistance to most of the chemicals within a short time. Again the pest is usually located in between the upper and the lower parts of the leaves-tunnels. This makes it difficult for it to be accessed by chemicals. To ensure an effective control of the pest, there is need to use IPM technologies. These include: Use of <i>Bacillus thuringiensis</i> which have shown efficacy in controlling outbreaks, use of inorganic pesticides such as Spinosad and Imidacloprid; Use of sex pheromone traps is highly effective on the males thus reducing the populations due to reduced fertilization of the females. Pheromone lures can be used for monitoring and mass trapping. For the other types of leaf miners, use of parasitic wasps such as <i>Diglyphus ssp</i> has proved effective; use of yellow sticky traps or yellow basins filled with water attract the adult leaf miner. These are later killed. Destruction of hosts such as old crop debris as well as having a rotation with non-host crops can help reduce leaf miner populations in the crop.
Justification	The Leaf miners ( <i>Tuta absoluta</i> ) are serious pests that cause damage to both the leaves and the tomato fruits. They cause high yield losses of 50-100%. There is therefore the need to use a combination of control practices and at an early stage to ensure that the pest is put under control before it causes serious damages to the crop. This calls for an integrated approach with effective scouting programmes in place to enable early detection for the pest in order to undertake appropriate control measures.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Fact sheets, farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.

<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of current practices may be difficult to achieve
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Capacity building and sensitization forums</li> <li>• Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness _</li> </ul>
Lessons learnt in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The cost of implementing IPM for <i>Tuta absoluta</i> for 1 acre KES. 20,000 for inputs (traps, chemicals, sticky traps) and labour @ KES. 10,000. (Total cost KES 30,000) per acre per season
Estimated returns	Potential yield of 18,000kgs per acre per season of tomato under good agronomic practices. Integrated pest management of <i>Tuta absoluta</i> increases yield by 50% (KES. 360,000) @ KES. 40/ kg
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Land ownership is mainly by men who may have no interest in production of quality tomato fruits</li> <li>• Women have limited access to agricultural and extension services hence they might not have adequate knowledge on <i>Tuta absoluta</i> management</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women and youth to be trained on integrated management of <i>Tuta absoluta</i> for improved yields</li> <li>• Empower women and youth to acquire land to increase productivity and incomes at household level</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	The VMG can easily participate in integrated management of <i>Tuta absoluta</i> control once sensitized
VMG related opportunities	<ul style="list-style-type: none"> <li>• Train VMGs to be lead farmers and part of the ToT team for training on itegrated management of <i>Tuta absoluta</i></li> <li>• Target VMGs farms for demonstration of management of <i>Tuta absoluta</i></li> </ul>
<b>E: Case studies/profiles of success stories</b>	

Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas who have been sensitized on <i>Tuta absoluta</i> control are successfully using the management practices.
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on leaf miner ( <i>Tuta absoluta</i> ) are documented
Status of TIMP (1. ready for up scaling 2, Requires validation 3. Requires further research)	Ready for up scaling
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, KU and JKUAT
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&C, County governments, Universities (KU and JKUAT)

<b>2.6.8 TIMP Name</b>	<p><b>Integrated management of Thrips (<i>Thrips tabaci</i>, <i>Frankliniella occidentalis</i>, <i>F. schultzei</i> and <i>Ceratothripoides brunneus</i>)</b></p>  <p>Western Flower Thrips: (a) nymph; (b) adult; (c) curling and drying of attacked leaves and (d); fruits damage by the thrips. Photo source: V Ochieng</p>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low yields due to thrip infestation and poor quality fruits that fetch low market prices. They are small insects, about 1 to 2 mm long that usually feed on the lower surface of leaves puncturing them and sucking

	<p>the exuding sap. They also attack buds, flowers and fruits. Attacked leaves have a silvery sheen and show small black spots (thrips excrements). Under heavy infestation attacked buds and flowers usually fall off. Attacked fruits show speckling and small necrotic patches on the surface affecting fruit quality. Fruits may become deformed. Thrips feed on tomatoes at all stages, but their feeding on seedlings is particularly damaging. Heavy infestation can reduce stands of young seedlings in hot weather. Thrips of the genus <i>Thrips</i> and <i>Frankliniella</i> are carriers of viruses such as the Tomato Spotted Wilt Virus (the most economically important virus in tomato production) and the Tomato Chlorotic Spot Virus.</p>
<p>What is it? (TIMP description)</p>	<p>Integrated control practice for thrips involves the use of natural enemies. Predatory mites (e.g. <i>Amblyseius</i> sp.), anthocorid bugs (e.g. <i>Orius</i> spp.), and other predators such as ladybird beetles, lacewings and spiders, and the fungus <i>Entomophthora</i> are important in natural control of thrips. Monitor the crop regularly. Check plants daily in the nursery, and crop borders in the field. Be particularly vigilant at flowering. Pay careful attention to flowers and flower buds. Destroy thrips pupae in the soil. This helps reducing subsequent thrips populations. Plough and harrow before transplanting to expose pupae in the soil from previously infested crops to natural enemies and desiccation. Soil Solarization and flood irrigation (flooding previously infested fields prior to planting/transplanting) destroy a large proportion of thrips pupae present in the soil;</p> <p>If necessary spray with bio pesticides. Neem and some other plant extracts are reported to control thrips. Apply Spinosad, a bacterial derivative effective in thrips control. However, timing of bio-pesticide application is important. Spraying early in the morning or in the evening and mixing the spray with a sugar solution (which attracts the thrips out of the flowers) are reported to increase efficacy of sprays.</p>
<p>Justification</p>	<p>Thrips are insect pests that cause severe damage to tomatoes and can lead to 40% yield losses since they attack the growing tips and flowers leading to flower</p>

	abortion. Their secretive habits (eggs are laid in plant tissue, the larvae and adult shelter in the flowers and larvae pupate in the soil) makes them quite difficult to control using chemical control method. This calls for an integrated approach with effective scouting programs in place to enable early detection for the pest in order to undertake appropriate control measures.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension service providers
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve
Suggestions for addressing the challenges	Capacity building and sensitization forums Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness _
Lessons learnt in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The cost of implementing IPM for thrips for 1 acre KES. 20,000 for inputs (traps, chemicals, sticky traps) and labour @ KES. 10,000. (Total cost KES 30,000) per acre per season
Estimated returns	Potential yield of 18,000kgs per acre per season of tomato under good agronomic practices. Integrated pest management of thrips increases yield by 40% (7200kg) @ KES. 40/ kg equivalent to KES. 216,000
Gender issues and concerns in development, dissemination, adoption and scaling up	Management of thrips can easily be adopted by all gender categories though some components such as spraying may be impractical for women

Gender related opportunities	All gender categories can participate in tomato IPM technology which has potential to increased yields of quality fruits and reduction in costs
VMG issues and concerns in development and dissemination	The VMG can easily participate in Integrated thrips control technology once sensitized
VMG related opportunities	Integrated thrips control practices can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
<b>E: Case studies/profiles of success stories</b>	
Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas and are managing thrips using IPM approach
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection are documented
Status of TIMP (1. ready for up scaling 2, Requires validation 3. Requires further research)	Ready for up scaling
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, KU and JKUAT
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&C, County governments, Universities (KU and JKUAT)


<b>2.6.9 TIMP Name</b>	<b>Pesticides for effectiveness in control of economic important pests for tomato</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	There is lack of information by farmers and agro-dealers on the efficacy of most agro-chemicals that are in the market today. Many agro-chemical companies have manufactured different types of pesticides for control of various tomato pests. However, their efficacies are not known while in some of them the information given on the labels does not seem to agree with the outcomes in the field once the pesticides are used for the control of pests. This therefore calls for an evaluation of the common pesticides in the market to determine their effectiveness.
What is it? (TIMP description)	The process will involve the purchase of the common pesticides used for the control of the economic pets for tomato from the agro-dealers. The pesticides that are

	used for control of similar pests but manufactured by different agro-chemical companies will be procured and tested for their efficacy on the tomato crop in different agro-ecological zones of the tomato growing counties in the project mandate areas.
Justification	Farmers in the tomato growing areas have used different kinds of pesticides for the control of various tomato pests with very little success. This has led to many of them getting desperate owing to the high losses they incur in the process of tomato production and resort to using acaricides meant to control ticks in cattle in the control of crop pests. This has exposed the consumers of tomatoes into high health risks.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension service providers
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of recommended practices practices maybe difficult to achieve
Suggestions for addressing the challenges	-Capacity building and sensitization forums -Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness _
Lessons learnt in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Basic cost including purchase of chemicals, knapsack sprayer, labour and operations KES 150,000 per acre
Estimated returns	Estimated returns per acre when chemical application is used increase yield by 85% (15,300kgs) @ KES. 40/kg at farm gate price

Gender issues and concerns in development, dissemination, adoption and scaling up	The management practice can easily be adopted by women, youths and the physically challenged
Gender related opportunities	All gender categories can participate in the evaluation of pesticides for determination of their efficacy technology which has potential to increased yields of quality fruits and reduction in costs
VMG issues and concerns in development, dissemination, adoption and scaling up	The VMG can easily participate in in the evaluation of pesticides for determination of their efficacy technology once sensitized
VMG related opportunities	Evaluation of pesticides for determination of their efficacy control practice can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
<b>E: Case studies/profiles of success stories</b>	
Success stories	Efficacy trials have routinely been conducted by accredited institution such as KALRO in collaboration with PCPB
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on approved tomato crop pest management products, PCPB List of Approved Pest Control Products
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Requires further research)
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta University and JKUAT.
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities

## Research Gap

1. Evaluation of pest and disease control products for efficacy (Continuous)\*

<p><b>2.6.10 TIMP Name</b></p>	<p><b>Pesticides for management of insect pests</b></p>  <p>Variety of properly labeled chemicals; stored in lockable cupboards</p>
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Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>• High incidence of pests and disease</li> <li>• Inappropriate use of synthetic chemical pesticides</li> </ul>
What is it? (TIMP description)	Pesticides are products intended for application to destroy pests and/or reduce their impact on quantity and quality of tomato crop and produce. The targeted pests may be weeds, insects, pathogens, rodents or birds. Pesticides have various types of formulations, e.g. suspension (liquid), granules, dust, fumigant, powder, aerosols. They can be applied using various methods including spraying, granule incorporation into soil, drenching, smearing, injection, fumigating. Pesticides can be applied at different stages in the tomato production cycle, e.g. at land preparation (e.g. herbicide), at planting, after planting or post-harvest.
Justification	Tomato is an important crop for food, nutrition and income security in Kenya. A wide range of pests and diseases limit production. Although there are different means of controlling the pests, most farmers turn to pesticides due to their effectiveness. However, pesticides are costly, and therefore reduce profits, they can be harmful to the environment and people. Inappropriate use of pesticides leaves residues on tomato fruits, which lowers their quality, it can also lead to pests becoming resistant. It is therefore important for farmers to understand the correct procedure of choosing pesticides, their safe use and management, and how to integrate to other pest/ disease management methods.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, agrovet dealers
Approaches used in dissemination	Trainings to farmers and agrovet dealers, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>- Sustained demand for effective disease control methods</li> <li>- Favorable climatic conditions for tomato production</li> <li>- Collaboration between all partners</li> </ul>
Partners/stakeholders for scaling up and their roles	KALRO and KU will conduct trials and research on pesticide use and their effectiveness under different agro-ecological conditions and pests/pathogen hotspots; KU will conduct research on pest/ disease distribution and strain diversity to guide pesticide use

	recommendations; County governments, farmers groups/CBOs, NGOs, agrovet dealers will implement extension.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	All areas where tomatoes are grown
Counties where TIMP will be upscaled	Kajiado, Kisumu, Siaya, Elgeyo Marakwet, Garissa, Mandera and others
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Lack of funds to purchase pesticides</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>-Provision of knowledge on appropriate use of pesticides</li> <li>-Training and demonstration on pesticide use</li> <li>-Economic analysis to convince growers on cost effectiveness</li> </ul>
Lessons learnt in upscaling, if any	The current mindset and dependence on pesticide to produce healthy tomato needs to be addressed.
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>- Guidelines on residue limits for locally consumed tomato</li> <li>-Favorable climatic conditions for tomato production</li> <li>-Sustained market demand for high quality tomato fruits.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Varies with pesticide product
Estimated returns	KES 500,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Application of pesticides may be cumbersome for some gender categories (women)</li> <li>- In some regions women and youth lack access and control over resources for production and benefits</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>- Any gender can participate in tomato production using recommended crop health management practices for increased production and income generation</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Application of pesticides may be cumbersome for some gender categories (women)</li> <li>- Some VMGs lack access and control over resources for production and benefits</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>- VMGs can be involved in in tomato production using recommended crop health management practices for increased production and income generation if issues of concern are addressed</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Appropriate use of pesticides in tomato production has been promoted in Kirinyaga, Embu and Murang'a under the ENBALE Horticulture project at KU/NRF.

Application guidelines for users	Production guidelines are provided by pesticide manufacturers.
F: <b>Status of TIMP readiness</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation and further research
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara; Kenyatta University, JKUAT
Lead organization and scientists	KALRO: Rebecca Faraay; Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities: KU, JKUAT

## Research Gaps

1. Evaluation of resistance to pesticides

<b>2.6.11 TIMP Name</b>	<b>Safe use of pesticides for disease management</b>
Category (i.e. technology, innovation or management practice)	<p>Management practice</p>  <p>Pesticide application while dressed in protective clothing</p>
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Excessive pesticides application to crops, use of pesticides for spraying crops without wearing the right spraying gear, storage of pesticides in non-designated stores, spraying against the wind direction and use of pesticides without following the guidelines given in the labels.
What is it? (TIMP description)	Capacity building of farmers and crop protection teams on safe handling and use of pesticides right from transportation from the agro-dealers to storage in their houses, mixing procedures and their application in the field in order to ensure safety of the crop, the person handling them and the environment at large.
Justification	Cases of improper use of pesticides are very common in most of the areas where tomatoes are grown. There have been

	incidences of excessive use, improper handling that lead to the spray attendants inhaling the chemicals in the process of spraying, use of inappropriate spray equipment that lead to leakages and thereby exposing the handlers to health risks as well as contamination of the water bodies through excessive chemical waste. Proper dressing and Most of these irregularities can easily be corrected through sensitization and capacity building forums so as the end users can be made aware of the best practices that should be used when handling pesticides.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makeni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve
Suggestions for addressing the challenges	-Capacity building and sensitization forums -Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness _
Lessons learnt in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Basic cost of using personal protective equipment in tomato is estimated at KES. 20,000 including training on their uses
Estimated returns	Farmers enjoy good health in return and minimum money is spent on treatment and health related issues
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth lack funds to buy personal protective gear</li> </ul>

	<ul style="list-style-type: none"> <li>• Slow information and awareness flow to female farmers due to their low academic levels</li> <li>• Improved training materials and strategies for farmer-saved-seed-system are not favorable to women farmers</li> </ul>
Gender related opportunities	Safe use and application of the pesticides offer opportunities to youth to form spray teams for income and livelihoods.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Majority of VMGs are food insecure and therefore may not be interested purchasing of the PPEs</li> <li>• Slow information and awareness flow to VMGs farmers due to low academic levels</li> <li>• Training materials and strategies safe use may not be favorable for VMGs</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Safe use of pesticides practice can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides</li> </ul>

#### **E: Case studies/profiles of success stories**

Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas who practice safe use of pesticides after sensitization in various forums and past research projects
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Ready for up scaling;

#### **F: Contacts**

Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta University and JKUAT.
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Abel Too, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities

<b>2.6.12 TIMP Name</b>	<b>Integrated disease management of tomato diseases using plant extracts</b>
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Tomato plants in the field and nurseries are usually attacked by a number of pests. Farmers have for a long time been struggling to control pests using chemical control practices with minimal success. At the same time, the agro-chemicals are expensive and unaffordable to the common farmer. The use of plant extracts for the control of pests will make the crop not

	only safe for consumption but also cheaper for the farmer.
What is it? (TIMP description)	Use of plant extracts for control of crop pests has been undertaken by farmers in various parts of the country. It involves the extraction of sap from leaves of medicinal plants for the control of pests. Such plants include neem, Tithonia, tobacco, pawpaw and chili plant. The extracts can be used alone or in combination so as to make them more effective and control more than one pest.
Justification	Demand for organically produced crop products has been on the increase in the recent years. These products also fetch premium prices in the market as they are free from chemical residues. Use of plant extracts lower the exposure to heavy metals, increase the yield and are safety to the environment. Once sprayed onto the tomato crop, harvesting can be done as early as the following day without having to observe the pre-harvest intervals.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve
Suggestions for addressing the challenges	-Capacity building and sensitization forums -Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness _
Lessons learnt in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice

<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Basic cost for plant extracts at KES 60,000 per acre per season for purchasing the plant extracts
Estimated returns	
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited knowledge on Integrated management of Integrated management of fall armyworm due to lack of access to agricultural information and extension services</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Integrated management of pest and diseases using plant extracts protocols will not overburden any gender in implementation and therefore has potential for adoption by both gender</li> <li>• Integrated management using plant extracts is cheap and reduces production costs therefore user friendly to poor women</li> <li>• Adoption of Integrated management using plant extracts will lead to improved productivity of tomato hence more income for women, increase yields of quality and safe fruits and reduce production costs</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited access to training and extension services so they might not be aware of integrated management using plant extracts</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Use of plant extracts to control pests can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on use of botanicals for pest control to be documented
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Requires further research)
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta University and JKUAT.

Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities

### Gaps

1. validation of efficacy of plant extracts for control of tomato pests
2. Determination of the plant extract rations for disease management


<b>2.6.13 TIMP Name</b>	<b>Intercropping of tomatoes with garlic and onions to control pests</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Increased use of pesticides for the control of various pests in tomato fields.
What is it? (TIMP description)	The TIMP entails planting onions and or garlic in between the rows of tomatoes. Garlic and onions have some medicinal properties and are also aromatic. The aroma/smell released by the intercrops will chase away the pests from the tomato plots thereby reducing the costs of pesticide's and at the same time make the end products safe for use.
Justification	Intercropping the tomato fields with garlic and or onions will not only keep away the pests from attacking the tomato crop but will also enable the farmer earn an extra income from the sale of the onions or garlic. The final product will also be safe to use, saves the farmer from the costs of pesticides and at the same time the practice is environmental friendly.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera

Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve
Suggestions for addressing the challenges	-Capacity building and sensitization forums -Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness _
Lessons learnt in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Basic variable costs KES 60,000 per acre per season
Estimated returns	KES 500, 000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited knowledge on Integrated management of Integrated management of fall armyworm due to lack of access to agricultural information and extension services</li> <li>• Women and youth might not be able purchase the chemical used for Integrated management of fall armyworm because they do not have finances due to limited access to credit facilities</li> <li>• Most of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on Integrated management of fall armyworm</li> </ul>
Gender related opportunities	All gender categories can participate in the intercropping of tomato with garlic and or onion technology which has potential to increased yields of quality and safe tomatoes and reduction in costs
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Majority of VMGs are food insecure and therefore may not be interested in intercropping systems</li> <li>• Slow information and awareness flow to VMGs farmers due to low academic levels</li> <li>• Training materials and training approaches in inter cropping for pest and diseases may not be favorable for VMGs</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• The VMG can easily participate in the intercropping of tomato with garlic technology once sensitized</li> </ul>
<b>E: Case studies/profiles of success stories</b>	

Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection to be documented
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Requires further research
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta University and JKUAT.
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities

## Research Gaps

Validate effect of intercropping tomatoes with garlic and onions to control pests

<b>2.6.14 TIMP Name</b>	<b>Soil Solarization for soil disease management</b> 
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Infestation of tomato plants planted in the soil by soil borne pests such as nematodes and chaffer grubs.
What is it? (TIMP description)	Solarization involves heating of soil media using solar energy before planting tomato seeds in a nursery bed or transplanting seedlings into the main seedbed. This is done by covering moistened soil media with transparent bio-degradable polythene sheet (gauge 500) under the hot sun for 4 to 6 weeks. The polythene sheet absorbs and traps heat and increases the temperatures in order to kill the soil borne pests.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators, Extension service providers
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs

Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings, Individual Farmers, farmer groups/CBOs to participate in the implementation of the various technologies for tomato production, KALRO and Universities to develop the technologies and conduct ToTs, NGOs to link farmers to the market and undertake farmer mobilization to lobby for changes in agricultural policies to favour the farmer.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kwale, Kilifi, Taita-Taveta, Machakos, Makueni
Counties where TIMPS will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve
Suggestions for addressing the challenges	-Capacity building and sensitization forums -Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness _
Lessons learnt in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The basic cost for purchasing the polythene paper is estimated at KES. 150,000 for 1 acre for 1 season. However the sheet can be reused for 4 seasons. Therefore basic cost is lowered to KES. 37,500
Estimated returns	Estimated returns for tomato for 1 acre reduces the crop loss yield by 100%. Therefore the estimated returns is maximum yield of 18000kgs/acre is achieved @ KES. 40/kg less the basic cost.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited knowledge on Integrated management of soil borne diseases using solarization due to lack of access to agricultural information and extension services</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• All gender categories can participate in the solarization technology which has potential to increase yields, quality and safety of tomatoes and reduce production costs</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The VMGs can easily participate in the solarization technology once sensitized</li> </ul>

	<ul style="list-style-type: none"> <li>• Slow information and awareness flow to VMGs farmers due to low academic levels</li> </ul>
VMG related opportunities	Solarization can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
<b>E: Case studies/profiles of success stories</b>	
Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas who were sensitized in previous initiatives and currently practice solarization
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	1. Ready for upscaling;
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta University and JKUAT.
Lead organization and scientists	KALRO: Agnes Ndegwa, Abel Too, Vincent Ochieng, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities

<b>2.6.16 TIMP Name</b>	<b>Integrated management of tomato diseases using crop rotation</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Disease build up as a result of continuous cultivation of tomatoes in the same field or greenhouse for a long period of time.
What is it? (TIMP description)	The TIMP involves the reduction of disease pathogens build up in a field or greenhouse by observing strict crop rotation procedures in tomato production. The rotation should be done in such a way that the crop that follows the tomato after harvest is not related to the tomato family which includes crops such as capsicum brinjals, black night shade and many others in the solaceae family. Suitable rotation crops include garlic, coriander, amaranth as well as leguminous crops.
Justification	Tomatoes are usually affected by a number of diseases as they grow. The disease causing organisms usually remain in the field with the crop residues and in the soil after the crop is harvested. Once a new crop of tomato is planted in the same field, the diseases will quickly multiply and start infecting the plants. By practicing crop rotation, the

	disease causing organisms will have nothing to feed on and will in the long run die. This will help in reducing their populations after a different crop that is not related to tomatoes is planted in the following season. The technique contributes to 14% to 90% increase in production
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension to offer Service, Individual Farmers farmer groups/CBOs to practice the technology, KALRO and the Universities to develop and fine tune the technology, NGOs for farmer mobilization and marketing of the produce.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already promoted if any	Taita-Taveta, Kirinyaga, Kajiado.
Counties where TIMP will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favor of current practices maybe difficult to achieve
Suggestions in addressing the challenges	Through capacity building and sensitization forums -Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness
Lessons learnt in up scaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Basic cost of establishing 1 acre of tomato is estimated at KES. 150,000
Estimated returns	By reducing crop losses at an average of 50%, the estimated returns based on the potential yield of 18000kg/acre per season @ KES.40/kg farm gate price, the farmer gains approximately KES. 360,000
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Crop rotation can be easily practiced by all gender categories</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• All gender categories can participate in crop rotation technology which has potential to increased yields, of quality and safety of produce as well as reduce production costs</li> </ul>

	<ul style="list-style-type: none"> <li>• Women have limited access to agricultural and extension services hence they might not have adequate knowledge crop rotation</li> <li>• Slow information and awareness flow to female farmers due to their low academic levels limits implementation of the crop rotation</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The VMGs can easily practice crop rotation once sensitized</li> <li>• Training materials and strategies for crop rotation may not be favorable for VMGs</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Adoption of crop rotation will lead to improved productivity of tomato hence more income for women</li> <li>• Adoption of Integrated management of pest and diseases will also lead to increased food security and nutrition for households</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Cases to note are individual farmers and groups sensitized on importance of crop rotation in previous projects and are now practicing it in commercial tomato business in major tomato growing areas
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Requires validation
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta University and JKUAT.
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities (KU, JKUAT)

<b>2.6.17 TIMP Name</b>	<b>Field sanitation as a means of controlling disease incidences ( Bacterial wilt, fusarium wilt, bacterial canker and viral diseases)</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	

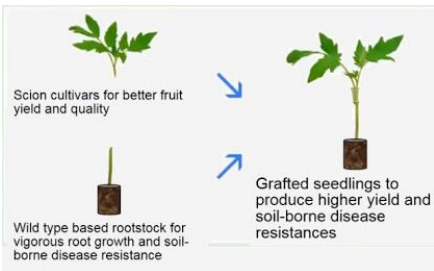
Problem addressed	High disease causing pathogens accumulation and frequent attacks to tomatoes leading to high production costs and low yield as a result of excessive use of agro-chemicals due to poor field sanitation conditions.
What is it? (TIMP description)	The TIMP involves the reduction of disease causing organisms build up in a field by observing strict sanitation procedures in tomato production. This entails ensuring that the tomato crop in either the open field or the greenhouse is free from weeds and the surrounding areas are also clear of weeds and other crop residues. The water used for irrigation should be clean and free from disease causing pathogens. Equipment used for weeding, pruning as well as materials used for mulching should always be clean and free from disease causing organisms.
Justification	There is an increase in production costs for tomatoes that end up eating into the profits due to increased use of fungicides and as a result of poor sanitation conditions in the tomato fields that lead to disease outbreaks. By observing proper sanitation conditions in the fields and greenhouses, the disease incidences could easily be reduced to a minimum (50%) thereby increasing the income levels of tomato producers.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools, brochures, posters and flyers
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension to offer Service, Individual Farmers farmer groups/CBOs to practice the technology, KALRO and the Universities to develop and fine tune the technology, NGOs for farmer mobilization and marketing of the produce.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already promoted if any	Taita-Taveta, Kirinyaga.
Counties where TIMP will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve
Suggestions in addressing the challenges	Through capacity building and sensitization forums Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness
Lessons learnt in up scaling if any	Farmer participatory approach works

Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Basic cost of operations ( purchasing of disinfectants, incinerators cost and labour for scouting) is KES 80,000 per acre per season
Estimated returns	Estimated increase in returns is 5400kgs @ KES. 40/kg farm gate price (KES 216, 000) per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Most of the decisions relating to the crop health and control are done by men as the head of the households for those who are married</li> <li>• Most of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols of field sanitation</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Integrated management through field sanitation is cheap and reduces production costs therefore user friendly to poor women</li> <li>• Adoption of field sanitation will lead to improved tomato productivity hence more income for women</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited access to productive resources such as land, credit, and quality seeds</li> <li>• Majority of VMGs are food insecure and therefore may not be interested in field sanitation</li> <li>• Slow information and awareness flow to VMGs farmers due to low academic levels affects the implementation</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Field sanitation technology can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas and practice field sanitation
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Requires validation
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta University and JKUAT
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities

<b>2.6.18 TIMP Name</b>	<b>Evaluation of fungicides for effectiveness in control of economic important diseases for tomato</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Presence of many and different types of fungicides in the market that are manufactured for use by tomato farmers for the control of diseases but their levels of efficacy is not known or is not corresponding to the instructions given in the label.
What is it? (TIMP description)	The TIMP involves sourcing of the different disease control chemicals manufactured by the different agro-chemical companies and evaluating them for their effectiveness in controlled research trials.
Justification	Tomato farmers have faced challenges related to recommended chemicals that are not effective in disease control. Most farmers end up purchasing more than one chemical for use in the control of the same disease. This leads to an increase in production costs as well as a destruction of the environment through excessive use of agro-chemicals. There is need to determine efficacy of these products continually to ensure that only products with good efficacy are recommended.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs
Most effective approach	Farmer participatory demonstrations/ farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension to offer Service, Individual Farmers farmer groups/CBOs to practice the technology, KALRO and the Universities to develop and fine tune the technology, NGOs for farmer mobilization and marketing of the produce.
<b>C: Current situation and future scaling up</b>	
Counties where technology is already promoted if any	Taita-Taveta, Kirinyaga.
Counties where TIMP will be up scaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Change of mindset in favour of current practices maybe difficult to achieve
Suggestions in addressing the challenges	Through capacity building and sensitization forums -Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness -On farm trials

Lessons learnt in up scaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 80,000 per acre for chemical control for diseases per acre per season
Estimated returns	Estimated returns per acre increases production by 100% (KES. 720,000)
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth might not be able purchase the chemical used for Integrated management because they do not have finances due to limited access to credit facilities</li> <li>• Most of the decisions relating to the crop health and control are done by men as the head of the households for those who are married</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Train VMGs to be lead farmers and part of the ToT team for training on safe use of chemicals</li> <li>• Target VMGs farms for demonstration on safe use of chemicals</li> <li>• Empower the VMGs who want to form spary teams</li> <li>• The TIMP has the potential of increasing production, hence improved household food security</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Laborious pest and disease management practices for VMGs</li> <li>• Dissemination methods and documents that are not always easy to understand or access</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Safety of VMG's is taken into account</li> <li>• The technology can improve food and nutrition security for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Cases to note are individual farmers and groups who are engaged in commercial tomato business in major tomato growing areas
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guidelines on tomato crop protection
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Requires further research
<b>F: Contacts</b>	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga, Deans of Agriculture, Kenyatta University and JKUAT.

Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities

<b>2.6.19 TIMP Name</b>	<b>Tomato Grafting for management of diseases</b>
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	High incidence of soil-borne disease such as bacterial wilt and fusarium wilt   <p>The diagram illustrates the tomato grafting process. On the left, there are two separate components: a 'Scion cultivars for better fruit yield and quality' (a green plantlet) and a 'Wild type based rootstock for vigorous root growth and soil-borne disease resistance' (a smaller plantlet in a pot). Blue arrows point from these two components towards a 'Grafted seedlings to produce higher yield and soil-borne disease resistances' (a single plant where the scion is joined to the rootstock).</p>
What is it? (TIMP description)	This is a technique in which a plant with proven resistance to soil-borne pathogens is used to enable the production of a high yielding variety that has high market demand but highly susceptible to the soil borne pathogen. The preferred variety is used as the source of scion and joined to the resistant variety which serves as a rootstock.
Justification	Soil-borne pathogens especially bacterial wilt caused by <i>Ralstonia solanacearum</i> and fusarium wilt ( <i>Fusarium oxysporum</i> fsp. <i>lycopersici</i> ) are a major challenge to Tomato production that cause 100% crop losses. The bacteria survive for long in the soil and most farmers are compelled to abandon their fields once attacked occurs and the soil is infected. There are no effective control measures for the pathogen. Susceptible tomato varieties with high market demand, e.g. Anna F1, Kilele F1, Cal J can be grafted onto wilt resistant germplasm of <i>Solanum incanum</i> , Eggplant or MT56. This could enable their production even in soil with high inoculum load of <i>Ralstonia</i> pathogen.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators, Extension service providers
Approaches used in dissemination	Trainings to farmers and propagators/nursery operators, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>- Sustained demand for disease resistant high yielding tomato seedlings</li> <li>- Favorable climatic conditions for tomato production</li> <li>- Collaboration between all partners</li> </ul>

Partners/stakeholders for scaling up and their roles	KALRO, KU, JKUAT, County governments, farmer groups/CBOs, NGOs, private nursery operators.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Not yet
Counties where TIMP will be upscaled	Kajiado, Kisumu, Siaya, Elgeyo Marakwet, Garissa, Mandera and others
Challenges in dissemination	-Lack of funds to purchase the more expensive grafted seedlings -Change of mindset in favour of current practices
Suggestions for addressing the challenges	-Provision of healthy affordable grafted seedlings -Training and demonstration of technology -Economic analysis to convince them on cost effectiveness _
Lessons learnt in upscaling, if any	Proof of effectiveness of the technology is necessary
Social, environmental, policy and market conditions necessary for development and upscaling.	-Certification guidelines for grafted tomato seedlings -Favorable climatic conditions for tomato production -Sustained market demand for seedlings and tomatoes.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The basic cost of acquiring the grafted seedlings with KES 15 @ 4000 seedlings per acre
Estimated returns	The estimated returns per acres when grafted seedlings are used increases yield by 100%. The estimated returns less basic cost gives maximum output (18000kg/acre per season @ KES. 40 farm gate).
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> <li>• Slow information and awareness flow to female farmers due to their low academic levels</li> <li>• Improved training materials and strategies for grafting techniques are not favorable to women farmers</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Empower women and youth to acquire land</li> <li>• Train women and youth to be lead farmers and part of the ToT team for training on tomato grafting</li> <li>• Empower the women and youth who want to start nursery business with grafting technologies by linking them with credit facilities</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Grafting may be a challenging technology to practice for VMGs who are physically challenged</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• VMGs can be involved in nursery operations and seedling sales.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Farmers trained under the IPM CRSP project successfully tested the grafted tomato seedling technology

Application guidelines for users	Grafting protocol to be developed suited for Kenya
<b>F: STATUS OF TIMP READINESS</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation and further research
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara; Kenyatta University, JKUAT
Lead organization and scientists	KALRO: Rebecca Faraay; Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities (KU, JKUAT)

### Gaps

1. Evaluation of performance of grafted tomato varieties/ seedlings under different agro-ecological conditions
2. Identification of additional bacterial wilt resistant rootstocks for tomato grafting

<b>2.6.20 TIMP Name</b>	<b>Disease resistant varieties</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	-High incidence of pests and disease -Indiscriminate use of synthetic chemical pesticides
What is it? (TIMP description)	Resistant varieties have inherent genetic capacity to tolerate and/or resist important pests and diseases. A variety with resistance to a specific pest/pathogen does not require additional application of chemical pesticides to manage the specific pest/disease. A pest/ disease resistant variety may also possess other attributes such as high yielding and early maturity. Varieties with tolerance to different pests and diseases have been promoted in different regions where tomatoes are grown. These include: Fortune Maker, Kentom, Taiwan F1 tolerant to bacterial wilt; Roma VNF, Shengena, Tengeru-97, Kentom tolerant to root knot nematodes. When purchasing seed farmers should ask for varieties that are tolerant to the main pests and diseases prevalent in their regions. Growers can use codes on the label to identify tolerance of different varieties. For example Roma VFN indicate tolerance to Verticilium wilt (V), Fusarium wilt (F) and Nematodes (N). Other codes may indicate A for Alternaria leaf spot; TSWV for Tomato Spotted wilt virus; Zara F1 is resistant to bacterial wilt, intermediate resistance to tomato yellow leaf curl virus, mosaic virus, and fusarium wilt race one and two; Shanty F1 is highly tolerant to nematodes.
Justification	Tomato is an important crop for food, nutrition and income security in Kenya. A wide range of pests and diseases limit production. Most farmers have to rely on chemical pesticides to

	control pests and diseases. In some areas farmers are compelled to abandon fields due to pests and diseases. Resistant varieties offer a sustainable and environment friendly strategy for pests and disease control.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators
Approaches used in dissemination	Trainings to farmers and propagators/nursery operators, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, electronic platforms, through input sellers
Critical/essential factors for successful promotion	-Sustained demand for disease resistant and high yielding tomato varieties -Favorable climatic conditions for tomato production -Collaboration between all partners
Partners/stakeholders for scaling up and their roles	KALRO, KU, JKUAT will conduct trials and research on performance of varieties under different agro-ecological conditions and pests/disease hotspots; KU will conduct research on pest/ disease distribution to guide dissemination of resistant varieties; County governments, farmers groups/CBOs, NGOs, private nursery operators will implement extension.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kajiado, Siaya and Garissa
Counties where TIMP will be upscaled	Kajiado, Kisumu, Siaya, Elgeyo Marakwet, Garissa, Mandera and others
Challenges in dissemination	-Lack of funds to purchase the more expensive grafted seedlings -Change of mindset in favor of current practices
Suggestions for addressing the challenges	-Provision of healthy affordable grafted seedlings -Training and demonstration of technology -Economic analysis to convince them on cost effectiveness
Lessons learnt in upscaling, if any	Proof of effectiveness of the technology is necessary
Social, environmental, policy and market conditions necessary for development and upscaling	-Certification guidelines for grafted tomato seedlings -Favorable climatic conditions for tomato production -Sustained market demand for seedlings and tomatoes.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Varies with variety
Estimated returns	KES 720,000 per acre per season
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited knowledge on use of resistant varieties due to lack of access to agricultural information and extension services</li> <li>• Women and youth might not be able purchase the resistant varieties used for Integrated management of tomato diseases because they do not have finances due to limited access to credit facilities</li> </ul>

Gender related opportunities	<ul style="list-style-type: none"> <li>Any gender can participate in tomato production and marketing which increases opportunities for income using th resistant varieties</li> <li>In some regions women and youth lack access and control over resources for production and benefits</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>Dissemination methods and documents that are not always easy to understand or access</li> <li>VMGs have limited access to productive resources such as land, credit, and quality seeds</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>VMGs can be involved in different parts of the tomato value chain.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Various disease/pest resistant or tolerant varieties are currently being promoted
Application guidelines for users	Production guidelines are provided by seed merchants
<b>F: STATUS OF TIMP READINESS</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara; Kenyatta University, JKUAT
Lead organization and scientists	KALRO: Rebecca Faraay; Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities (KU, JKUAT)

### Research Gap

1. Evaluation of performance of resistant varieties under different agro-ecological conditions and disease/pest hotspots
2. Development of pest / disease distribution maps to guide dissemination of resistant varieties in Kenya

<b>2.6.21 TIMP Name</b>	<b>Biological control</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low productivity due to incidence of pests and disease Inappropriate use of synthetic chemical pesticides
What is it? (TIMP description)	Bio-control is an approach that uses living organisms or their products to suppress pests/ pathogens and detrimental effects on cultivated crops. Bio-control is environment friendly and a more sustainable method compared to chemical products. The targeted pests may be weeds, insects, or microbial pathogens including

	nematodes. Bio-pesticides have various types of formulations and they can be applied using various methods including spraying, granule incorporation into soil, drenching, dipping or smearing. For insect control, predators are released into the fields where the pests occur and once established they can sustain their populations over extended periods of time. Depending on the target pest, bio-control products can be applied at different stages of the tomato crop growth.
Justification	Tomato is an important crop for food, nutrition and income security in Kenya. A wide range of pests and diseases limit production. Most farmers prefer to use pesticides for pest control but these are costly, and can be harmful to the environment and people. In addition, inappropriate use of pesticides leaves residues on tomato fruits, which lowers their quality and can lead to pests becoming resistant. Bio-control products are a suitable and more environment friendly alternative for pest control.
Region promoted	Bio-pesticides targeting different types of pests have been promoted in different regions in Kenya.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, agrovet dealers
Approaches used in dissemination	Trainings to farmers and agrovet dealers, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	Sustained demand for effective disease control methods Favorable climatic conditions for tomato production Collaboration between all partners
Partners/stakeholders for scaling up and their roles	KALRO, KU, JKUAT will conduct trials and research on biopesticide use and their effectiveness under different agro-ecological conditions and pests/pathogen hotspots; County governments, farmer groups/CBOs, NGOs and Agrovet dealers will implement extension.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	All areas where tomatoes are grown
Counties where TIMP will be upscaled	Kajiado, Kisumu, Siaya, Elgeyo Marakwet, Garissa, Mandera and others
Challenges in dissemination	-Perception of biopesticides being slow acting -Some bio-products cost more than synthetic products -Lack of funds to purchase bio-pesticides -Nonexistent distribution network bio-pesticides
Suggestions for addressing the challenges	-Training and demonstration on bio-pesticide use -Economic analysis to convince growers on cost effectiveness -avail affordable effective biocontrol products
Lessons learnt in upscaling, if any	-Marketing of bio-pesticides needs an effective strategy -Better demonstration of their effectiveness necessary
Social, environmental, policy and market	- Guidelines on pesticide residue limits for tomato -Favorable climatic conditions for tomato production

conditions necessary for development and upscaling	-Sustained market demand for high quality tomato fruits.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Varies with bio-pesticide product
Estimated returns	KES 500,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women have limited access to agricultural and extension services hence they might not have adequate knowledge on resistant varieties</li> <li>• Women and youth lack funds to buy seed storage materials</li> <li>• Slow information and awareness flow to female farmers due to their low academic levels</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women and youth to be trained on biological controls for improved productivity</li> <li>• Empower women and youth to acquire land</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Slow information and awareness flow to VMGs farmers due to low academic levels</li> <li>• Training materials and strategies for biological control may not be favorable for VMGs</li> </ul>
VMG related opportunities	VMGs can be involved in different parts of the tomato value chain.
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Use of bio-pesticides in tomato production has been researched and promoted in Kirinyaga, Embu, Murang'a, under KU/Osho project on bio-prospecting for natural pest control products. Examples: BioCure, <i>Trichoderma</i> , <i>Beuveria bassiana</i> , <i>Bacillus</i> sp., <i>Pseudomonas</i> isolates etc are in the market for control of various pests/ pathogens. Parasitic wasps, e.g. <i>Cotesia</i> , predatory mites ( <i>Phytoseiust</i> spp.), spiders, have been used in control of insect pests.
Application guidelines for users	Production guidelines are provided by bio-pesticide producers.
<b>F: STATUS OF TIMP READINESS</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara; Kenyatta University, JKUAT
Lead organization and scientists	KALRO: Rebecca Faraay; Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities (KU, JKUAT)

## Research Gaps

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

<b>2.6.22 TIMP Name</b>	<b>Integrated pest management of using trap crops</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low productivity due to high incidence of pests and disease Inappropriate use of synthetic chemical pesticides contributing to environmental degradation and increased greenhouse gas emissions
What is it? (TIMP description)	Trap cropping is a pest (nematode) management technique. Susceptible plant host is planted and larvae of a sedentary parasitic nematode such as root-knot are attracted to the plant where they enter and establish a feeding site on the plant. Once the female nematodes are trapped within the root, the trap crop is destroyed before the life cycle of the nematode can be completed, thus significantly reducing the pest population. Trap crops can be selected from among crops with economic or nutrition value.
Justification	Tomato is an important crop for food, nutrition and income security in Kenya. A wide range of pests and diseases limit production. Most farmers turn to pesticides due to their effectiveness but these are costly and can be harmful to the environment and people. Trap crops can be a suitable alternative to use of chemical pesticides if well integrated into pest control programmes.
Region promoted	Kirinyaga
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers
Approaches used in dissemination	Trainings to farmers, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	-Sustained demand for effective disease control methods -Favorable climatic conditions for tomato production -Collaboration between all partners
Partners/stakeholders for scaling up and their roles	KALRO, JKUAT and KU will conduct trials and research on trap crops and their effectiveness under pests/pathogen hotspots; County governments, farmer groups/CBOs and NGOs, will implement extension.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Not known
Counties where TIMP will be upscaled	Kajiado, Kisumu, Siaya, Elgeyo Marakwet, Garissa and Mandera

Challenges in dissemination	Destruction of the trap crop perceived as wasteful
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>-Use trap crop that has economic or nutrition value</li> <li>-Provision of knowledge on appropriate use of trap crops</li> <li>-Training and demonstration on trap crops</li> <li>-Economic analysis to convince growers on cost effectiveness</li> </ul>
Lessons learnt in upscaling, if any	The current mindset and dependence on pesticide to produce healthy tomato needs to be addressed.
Social, environmental, policy and market conditions necessary for development and upscaling.	<ul style="list-style-type: none"> <li>• Favorable climatic conditions for tomato production</li> <li>• Sustained market demand for high quality tomato fruits</li> <li>• Farmers willingness</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The basic cost for the trap crops seed and labor for establishment of 1 acre for tomato production is KES. 10,000
Estimated returns	Estimated returns on use of the trap crops increases production by 40% (7,200 Kgs per acre per season @ KES. 40 farm gate price) less the basic costs.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth might not be able purchase the seeds of the trap crops used for Integrated management of pest and diseases</li> <li>• Most of the decisions relating to the crop health and control are done by men as the head of the households for those who are married</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Trap crop management of pest and diseases is cheap and reduces production costs therefore user friendly to poor rural women</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> <li>• VMGs have limited access to productive resources such as land, credit, and quality seeds</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Safety of VMG's is taken into account</li> <li>• The technology can improve food and nutrition security for VMGs</li> <li>• Adoption of integrated management of trap crops will lead to improved productivity of tomato hence more income for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Carrots can be used to trap root knot nematodes

Application guidelines for users	Brochures, Training of Trainers manuals, Fact sheets and flyers
<b>F: STATUS OF TIMP READINESS</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation and further research
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara; Kenyatta University, JKUAT
Lead organization and scientists	KALRO: Rebecca Faraay; Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&C, County governments, Universities (KU, JKUAT)

## Research Gap

1. Validation of trap crop technology

<b>2.6.23 TIMP name</b>	<b>Integrated disease management using seed dressing</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low crop yields and incomes due to poor plant establishment is often associated with early pest and disease infections. Seedling blights and damping off are common problems that lead to poor seed germination and seedling survival
What is it? (TIMP description)	Seeds are treated with chemical pesticides such as Thiram, Apron Star, Celest®Top, Cruiser® 350FS, Dividend® 030fs, Maxim XI® 035FS, Seed Plus 30WS, Mancolax 72% WP, Marshal 350 ST, Protreat 350fs. This is especially important for seeds extracted by farmers. The seeds are placed in a container and the chemical applied according to the instructions on the label.
Justification	The technology offers protection to the seed and young seedling resulting in better germination and better plant establishment. It also stimulates root development leading to vigorous starts, uniform growth and higher yields. Use of seed dressing technology reduces crop losses of up to 50%.
Region promoted	Kajiado (Plant raisers - Isinya), Kiambu, Naivasha (Longonot nurseries)
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial vegetable nursery operators

Approaches to be used in dissemination	Farmer trainings, Farmer participatory demonstrations, Farmer field schools
Most effective approach	Farmer participatory demonstrations, Farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Extension service providers for : County, farmer groups and CBOs for promoting the technology, Student interns for capacity building, Agrochemical companies and seed companies for provision of inputs
<b>C: Current situation and future scaling up</b>	
Current extent of reach	Not yet adopted, requires validation
Counties where already promoted, if any	none
Counties where TIMP will be upscaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera,
Challenges in dissemination	High cost of the seed dresser Low levels of awareness Un availability of the seed dressing chemicals
Suggestions for addressing the challenges	Forming farmer groups and cooperative societies for bulk purchases
Lessons learnt in upscaling, if any	N/A
Social, environmental, policy and market conditions necessary for development and upsaling	Not done
<b>D: Economic, gender, and vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The basic cost of seed dresser for 1 acre seeds at KES. 10,000 and KES. 2000 for labour

Estimated returns	(Estimated returns for tomato under good agricultural practice is at 18,000kg per acre per season at KES 40. Per kg under good agricultural practices). With the use of seed dressing technology, there is increased crop yield by 50%. With the adoption of the management practice farmers can gain up to KSE. 360,000
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth lack funds to buy seed dressing chemicals</li> <li>• Slow information and awareness flow to female farmers due to their low academic levels</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Adoption of seed dressing technologies lead to increased food security and nutrition for households</li> <li>• Seed dressing technologies allows adoption that leads to employment opportunities for women and youth at various nodes of tomato value chain</li> <li>• There will also a reduction of cost of production for women if Integrated management of soil borne diseases is adopted</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Dissemination methods and documents that are not always easy to understand or access</li> <li>• VMGs have limited access to productive resources such as land, credit, and quality chemicals</li> <li>• VMGs have limited access to training and extension services so they might not be aware of seed dressing technologies</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Adoption of seed dressing of tomato seeds will lead to improved productivity of tomato hence more income for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for users	Brochure and fact sheet with detailed guide on seed dressing documented
F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>G: Contacts</b>	

Contacts	Jomo Kenyatta University of Agriculture and Technology (JKUAT), Department of Horticulture and Food Security
Lead organization and scientists	KALRO, JKUAT, John M. Wesonga, Boniface Muteshi, Francis Ombwara, Losenge Turoop
Partner organizations	Real IPM, Koppert, BazerEA, DuduTech

<b>2.6.24 TIMP name</b>	<b>Quarantine and movement restriction for management of diseases (Bacterial wilt, fusarium wilt, Tomato spotted wilt virus, Tuta absoluta)</b>
Category (i.e. technology, innovation or management practice)	Management Practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	High crop losses and incidences of pests and diseases in tomato production systems
What is it? (TIMP description)	This entails restriction of access to and movement within production areas. Strict procedures involving disinfection and cleaning are followed before access to production sites. Movement of animals into production site is eliminated and tools and other equipment and implements are cleaned before use in production places.
Justification	This is a preventive method that minimizes pest infestation and disease infection. Restricted pest and diseases can cause 100% crop loss. It is a first line of defence against pests and diseases that ensures minimal costs of dealing with outbreak. It contributes to product safety through minimal use of pesticides and guarantee food the food safety. Due to low pesticide usage production costs are also lower. This method targets viral and bacterial diseases such as Tomato ringspot nepovirus and bacterial wilt. It can also reduce problems of <i>Tuta absoluta</i> , whiteflies, spider mites, Tomato potato psyllid among others.
Region promoted	Kajiado (Plant raisers - Isinya), Kiambu, Naivasha (Longonot nurseries)
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, commercial tomato nursery operators, tomato growers, consultants
Approaches to be used in dissemination	Farmer trainings, Farmer participatory demonstrations, Farmer field schools


Most effective approach	Farmer participatory demonstrations, Farmer field schools
Critical/essential factors for successful promotion	Collaboration between all partners Adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	Extension service providers: County extension staff, farmer groups and CBOs for promoting the management practice, Student interns for sensitizing farmers and building their capacity , Media for creating awareness
<b>C: Current situation and future scaling up</b>	
Current extent of reach	Adopted by some individual farmers and some agropreneurs as a business but requires up-scaling
Counties where already promoted, if any	Kajiado, Nakuru
Counties where TIMP will be upscaled	Future scaling up: Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera
Challenges in dissemination	Capital cost in setting up structures for restricting and controlling movement may be prohibitive for many farmers Access to credit for farmers
Suggestions for addressing the challenges	Linking farmers to funding sources
Lessons learnt in upscaling, if any	N/A
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Favourable climatic conditions for tomato production</li> <li>• Sustained market demand for high quality tomato fruits</li> <li>• Farmers willingness to undertake the quarantine and restrictions</li> <li>• Favorable policies for the implementation of the management practice</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Variable depending on size
Estimated returns	No direct cost

Gender issues and concerns in development, dissemination, adoption an scaling up	<ul style="list-style-type: none"> <li>• Women and youth lack funds to buy seed storage materials</li> <li>• Slow information and awareness flow to female farmers due to their low academic levels</li> <li>• Improved training materials and strategies for quarantine and restrictions are not favourable to women farmers and youth</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Train women and youth to be lead farmers and part of the ToT team for training on quarantine and restriction of plant materials to minimise spread of pest and diseases</li> <li>•</li> <li>•</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Majority of VMGs are food insecure and therefore may not be interested in quarantine and restriction practices</li> <li>• Slow information and awareness flow to VMGs farmers due to low academic levels</li> <li>• Training materials and strategies for maize seed may not be favorable for VMGs</li> <li>•</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Better practices can contribute to access to empowerment of the VMG to community practice and synchronized production for tomato</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Plantec Naivasha and Plant Raisers have quarantine and controlled movement which enables them to produce high quality pest free seedlings.
Application guidelines for users	Brochure and fact sheet with detailed guide on quarantine and controlled movement
F: Status of TIMP readiness ( <b>1.</b> Ready for upsaling; <b>2.</b> Requires validation; <b>3.</b> Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO, Agnes Ndegwa, Rebecca Faraay
Partner organizations	JKUAT, MoALF&C, Seed Companies (e.g. Sygenta, Kenya Highland Seed Company, Amiran, Simlaw Seeds), Agrotunnel International Ltd

## Research Gaps

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

## 2.7 Weeds Management

2.7.1.TIMP Name	Integrated Weed Management for Tomatoes
Category: (Technology, Innovation or Management practice)	Management practices
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<p>Significant tomato yield loss attributed with weed competition for nutrients, moisture, space and sunlight. In addition increased cost of production emanating from weeds hosting insect pests and pathogens thus creating an environment conducive for disease occurrence. Some of the major weeds in tomato production include grasses such as couch, kikuyu, star grass and annual broadleaved weeds including black jack, gallant soldier, mexican marigold, Portulaca oleraceae and wandering jew.</p>
	<div style="text-align: center;">  <p>1. Mexican marigold 2. Gallant soldier 3. Black jack (Source; Hottensiah Mwangi-KALRO )</p> </div>
What is it? (TIMP description)	<p>Integrated weed management (IWM) is the management of weeds using two or more approaches such as preventive, physical control, biological control, use of biodegradable mulch, cultural, mechanical and chemical control.</p> <p>Physical control is the removal of weeds manually or mechanically, such as hand weeding or mowing. Biological control is where you use allelopathic effect, grazing animals, or insects. Cultural control includes the practice of crop rotation since various crops may influence the diversity and abundance of particular weed flora and using robust growing varieties that cover the soil quickly enough to suppress weeds. Mechanical weed management includes use of farm equipment e.g use of a motorized knap weeder, which does the work much faster and is less tedious. Chemical weed management involves use of pre-emergence selective herbicides and post-emergence herbicides.</p>

	In manual weeding farmers carry out hand weeding at 2 weeks after planting and just before flowering (about 4-6 weeks).
Justification	Majority of tomato growers have high yield losses attributed to poor weed management approaches and poor timing for weed management operation. There is a wide weed biodiversity and no one weeding approach is effective on controlling all weed species, and this is a big problem One method will manage some and leave others. Manual weeding can be effective when done timely. However, it is time consuming and labour intensive, and not effective when done during wet conditions, because most weeds get re-established and therefore regrowth becomes another big problem.
	Herbicides is emerging as a promising option for weed control but requires indepth knowledge. Timely use of herbicides is effective, saves time and labour. There are several registered herbicides (Pesticide Control Board Manual) in the market that can be used by growers. Herbicides are classified according to mode of application based on time of application (Pre-emergence control weed weeds at germination stage or as they emerge from the soil. Post emergence herbicide is applied to control weeds which are existing and actively growing). Others herbicides are contact or systematic based on mode of action. In contact it will kill the parts covered by the herbicide and is best for annual weeds. The systemic is absorbed by the leaves or roots and then translocated through the plant system to the point of action. Selective and non-selective. Selective will kill some plants and non-selective will kill all. For effective control growers should use integrated weed management (two or more approaches) to keep weeds under control
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Extension workers, Agrodealers
Approaches used in dissemination	Demonstrations plots and Farmer Field days. Media (Online), On-farm trials Agricultural Innovation platforms, Digital platforms Agricultural shows Manuals,pamphlets,
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Promote integrated weed management using participatory approaches and involve stakeholders in VC.</li> <li>• Address environmental and safety concerns related to the use dherbicides</li> </ul>

	<ul style="list-style-type: none"> <li>• Accompany the promotion with demos and field days with farmers' groups and stakeholders to share the lessons on the effectiveness of the integrated weed management options using FFBS approach.</li> <li>• Develop producers' knowledge on biology of weeds and weed dynamics incropping systems.</li> <li>• Farmers need training on timing with regard to conservation of biodiversity. Preserve pollinators for increased productivity of weed control.</li> </ul>
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> <li>• KALRO-Avail technical skills and technical backstopping</li> <li>• Universities-Technical backstopping</li> <li>• National and County Ministry of Agriculture, Livestock, Fisheries &amp; Irrigation-Extension services</li> <li>• Kenya Plant Health Inspectorate Services (KEPHIS)- Residue analysis</li> <li>• Pesticide Control Board –Registered herbicide list to protect users.</li> <li>• CBOs, NGO's- Participate in technology dissemination</li> <li>• Service providers i.e. Herbicide supply and safety gears supply</li> <li>• Farmers: Test/validate and produce</li> <li>• CGIARS e.g. IITA: Donors: Funding and technical backstopping</li> <li>• Agrochemical companies, Research partner (KALRO,CIAT), County extension staffs, NGOs</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Altitude areas of 1500-2000 meters above sea level e.g.Bomet, Nakuru, Nandi, Laikipia, Nyeri
Counties where TIMPs will be up scaled	Laikipia and Nyeri
Challenges in development and dissemination	<ul style="list-style-type: none"> <li>• Inadequate weed biology knowledge</li> <li>• Inadequate knowledge and information to determine and chose the best option among available approaches of weed management to minimize weed loss.eg what to use and when to use them</li> <li>• Poor choice and timing of herbicide application</li> <li>• High cost of herbicides</li> <li>• Myths on appropriateness of using herbicides</li> </ul>

Suggestion for addressing the challenges	<ul style="list-style-type: none"> <li>• Develop and disseminate information to various stakeholders</li> <li>• Training on integrated approaches using available methods</li> <li>• Train stakeholders on weed biology to enable choice of best options</li> <li>• Build capacity for appropriate herbicides use and safety of user.</li> <li>• Develop stakeholder capacity on social, environmental, health concerns attributed to herbicide use.</li> </ul>
Lesson learned in up scaling if any	<p>That integrated approaches of weed management:</p> <ul style="list-style-type: none"> <li>• Are more effective than use of one method</li> <li>• Results to increased productivity.</li> <li>• Are safer, <del>environmentally</del> friendly, and more sustainable.</li> <li>• Continuous use of herbicide is an environmental, health and social hazard.</li> </ul>
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Train on understanding the working of an integrated weed management.</li> <li>• Have an environmental and safety plan when using herbicides</li> <li>• Address the environmental and social concerns related to use of agrochemicals.</li> <li>• A functional agro-dealer network to supply the products when required by the farmers</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<ul style="list-style-type: none"> <li>• Land preparation (clearing &amp; plowing) per acre = Ksh 10,000</li> <li>• Pre-emergence herbicide cost per litre @ acre = Ksh 2500/ or post emergence herbicide @ 5000 per litre.</li> <li>• Herbicide application = one person = Ksh 1000/</li> <li>• Clean water for mixing with herbicide = Ksh 500/ acre</li> <li>• One weeding 5 persons * 500 @ = ksh 2,500/</li> </ul>
Estimated returns	Not yet established
Gender issues and concerns in development dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited access to production resources such as land, capital to purchase some of the inputs used for IWM in tomatoes</li> <li>• Women work is complicated by their multiple roles they do such as domestic roles</li> <li>• Women and youth have limited access to education, training and extension services</li> </ul>

	<ul style="list-style-type: none"> <li>• Women have less access to agricultural information, technology and knowledge on IWM</li> <li>• Women and youth have less access to knowledge and information on IWM</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Use of IWM technology can reduce labour from manual weeding and save time for other activities for women and children</li> <li>• Women and youth to generate income from weeding</li> <li>• Women and youth to generate income from agro dealer business</li> <li>• Women and youth to generate income by starting cortege value addition factories due to enhanced yield</li> <li>• There will be improved food security and nutrition from for women</li> <li>• There will be increased job security for women and youth by spraying herbicides</li> <li>• There will be increased production since the weed competes with plants leading to low production</li> </ul>
Vulnerable and marginalized groups (VMG) issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMG groups could have limitations in accessing the knowledge, resources and exposed to many threats such as insecurity and land disputes.</li> <li>• VMG have less access to extension training as they are not given equal opportunities</li> <li>• VMG have less access to knowledge and information on IWM</li> <li>• VMG have less access to capital to purchase herbicides</li> </ul>
VMG related opportunities	<p>VMG to generate income from agro dealer business</p> <p>VMG to generate income by starting cortege value addition factories due to enhanced yield</p> <p>There will be increased production leading to increase food security and nutrition for VMGs</p>
Gender issues and concerns in development and dissemination	Since weeding for mostly done by women and children, dissemination strategies should target women more but also take care of men so they become aware of the TIMP.
Gender issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> <li>• Make all gender understand the benefits of IWM.</li> </ul>

	<ul style="list-style-type: none"> <li>• Empower both men and women to make a judicious decision on IWM approach.</li> <li>• Use of IWM technology can reduce drudgery due to manual weeding and save time for other activities to women</li> </ul>
Gender related opportunities	Labour is reduced therefore an opportunities exists for women and youth to have time to get into other economic activities including the processing and marketing.
Vulnerable and marginalized groups (VMG) issues and concerns in development, dissemination, adoption and scaling up	VMG groups could be limited in accessing the knowledge, resources and exposed to many threats such as insecurity and land disputes.
VMG related opportunities	Training VMG on IWM practices and opportunities
<b>E: Case studies/profiles of success stories</b>	
Success stories	
Application guidelines for users	Extension and training material available
<b>F: Status of TIMP Readiness</b>	Ready for up scaling
<b>G: Contacts</b>	
Contacts	Center Director KALRO Kabete, Waiyaki Way, P.O Box 14733-00800, Nairobi
Lead organization and scientists	KALRO, Kabete/ KALRO Muguga Dr Hottensiah Mwangi, Dr Jedidah M. Maina, Charity, W.Muchira.
Partner organizations	Kenya Seed Company, Faida Seed, Agrosoy seed, NGOs, CBOs, County Governments, KEPHIS

<b>2.7.2 TIMP Name</b>	<b>Cultural methods of weed management</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	High incidence of weeds coupled with inappropriate and unsustainable methods used to control weeds reducing profitability reducing productivity limited knowledge on weeds
What is it? (TIMP description)	<p><b>Cultural methods</b> Cultural methods of weed control utilize common practices suitable for land and water management. These include planting weed-free crop seed, use of the right spacing, use of cover crops, use of mulch, intercropping and crop rotation.</p> <p><b>1 Crop rotation-</b> Rotating crops helps to terminate the life cycle of some weeds that infest a particular crop. This is effective especially in control of parasitic weeds or where certain weeds are</p>

associated with a given crop and in absence of the host crop the weed may not survive

**2 Mulching**-This involves covering the soil using dead plant material or polythene material which serve as a physical barrier to weed seeds getting optimum conditions for germination like light and space. When plastic material is used, solarization occurs where the high temperature kills weed seeds. When plant material is used there is possibility of allelopathic effects which may hinder weeds germination. It is advisable to select mulch materials carefully to avoid flowers and seeds that can introduce more weed seeds into the field.

**3 Appropriate crop spacing**- widely spaced plants leave large area bare for weed growth while too close spacing may cause severe competition between the crop plants. It is therefore important to use the correct spacing for each crop to ensure faster cover development to shade the weeds that attempt to grow. Spacing recommendations may differ from one region to another based on prevailing environmental conditions. Closer spacing is done in more favourable growing conditions while in drought prone environments wider spacing is advocated.

**4 Cover crops**- Planting crops that grow rapidly helps to suppress weeds before they grow. Some cover crops like black oats will control weeds by producing chemicals (allelopathy) that inhibit weed growth. Low growing crops like legumes with massive foliage are used as cover crops.

### **5 Cropping systems**

It exploits the diversity to intensify use of space and time for purpose of suppressing weeds

**5.1 Intercropping**—enhances canopy cover and extensive root system. The canopy will suppress weeds by blocking light to weeds while the extensive root system will deny weed roots space to get water and nutrients. An example is intercropping Tomato with African nightshade (*Solanum nigrum*).

### **5.2 Relay cropping or sequential cropping (time factor)**

Deprives the weed any chance to grow through a full cycle and produce seeds since there is no time the field has no crop. It minimizes the space in terms of time in regard to competition for space, water, and nutrients, for both to work the intercrops should be complementary e.g. legume and cereals. It works very well in case of parasitic angiosperms because

	they can induce the suicidal germination of the parasitic weed seeds.
Justification	Cultural methods of weed control are cost-effective options that have potential to ease the problem for farmers. Tomato is an important crop for food, nutrition and income generation in Kenya. A wide range of weed species reduce profitability of tomato production. Most farmers do hand weeding but labour is expensive and limited.
Region promoted	All counties growing tomatoes
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers
Approaches used in dissemination	Trainings to farmers, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	-Sustained demand for effective weed control methods -Favorable climatic conditions for tomato production -Collaboration between all partners
Partners/stakeholders for scaling up and their roles	KALRO, JKUAT and KU will conduct trials and research on trap crops and their effectiveness under pests/pathogen hotspots; County governments, farmers' groups/CBOs and NGOs will implement extension.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	All counties growing tomatoes
Counties where TIMP will be upscaled	Kajiado, Siaya, Elgeyo Marakwet, Garissa, Mandera
Challenges in dissemination	-Limited resource personnel
Suggestions for addressing the challenges	- Provision of knowledge and training on weeds biology and ecology. -Training and demonstration on appropriate timely intercrop for weed management -Economic analysis to convince growers on cost effectiveness.
Lessons learnt in upscaling, if any	The current mindset and dependence on manual weeding to produce healthy tomato needs to be addressed.
Social, environmental, policy and market conditions necessary for development and upscaling.	-Favorable climatic conditions for tomato production -Sustained market demand for high quality tomato fruits.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	To be determined
Estimated returns	KES - per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>Women have limited access to agricultural information, technology and knowledge</li> </ul>

	<ul style="list-style-type: none"> <li>• Cultural weed management is labor intensive in terms of handling and application hence may not be adopted by women who are already overburdened</li> <li>• Women and youth have limited access to land than men</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Use of cultural weed management in tomatoes can reduce labour from manual weeding and save time for other activities for women and children</li> <li>• Adoption of IPM of Cultural weed management will lead to improved productivity of tomato, hence more income for women</li> <li>• Adoption of IPM cultural weed management will also lead to increased food security and nutrition for households</li> <li>• Cultural weed management adoption will lead to employment opportunities for women and youth at various nodes of the tomato value chain</li> <li>• There will also a reduction of cost of production for women if Cultural weed management for tomatoes is adopted</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Weeding in tomato farms is labor intensive for VMGs to undertake</li> <li>• VMG groups could have limitations in accessing the TIMP due to limited access to agricultural information and extension</li> <li>• VMGs have no funds and resources to purchase herbicides due to limited access to credit facilities</li> <li>• VMGs might be able to read and understand the protocols and dissemination material written on cultural weed management due to low literacy levels</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• VMGs can utilize the practice as they engage in different parts of the tomato value chain</li> <li>• There is potential of increased production of tomato which will lead to increased food security and nutrition.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Intercropping of African nightshade and tomatoes projects
Application guidelines for users	Guidelines are needed
<b>F: STATUS OF TIMP READINESS</b>	Ready for upscaling
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara and KALRO- Kabete.
Lead organization and scientists	KALRO: Dr Hottensiah Mwangi, Dr J. Maina.

Partner organizations	MoALF&C, County governments/Extension, farmers.
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<b>2.7.3 TIMP Name</b>	<b>Use of cover crop for weed management</b>
Category	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	-High occurrence of difficult weeds to control -Limited knowledge on weeds -Inappropriate, inefficient and unsustainable methods used to control weeds. -Climate effects.
What is it? (TIMP description)	Cover crops is a technology where crops are carefully selected for covering the ground to suppress weeds, smoother weeds and other benefits for crop health. They should have vigorous growth characteristic, and are managed before seed setting. Management can be by use of post emergence herbicides (are the chemicals used to kill any herbs). Post emergence herbicides are applied when cover crop is actively growing before seed setting. The crop residue suppresses weed seedling establishment. The cover crops can also be managed by rolling with motor roller or mechanical roller to cover ground. In addition it can be cut and spread to cover ground as mulch. All emerging weed seedlings are suppressed by physical barriers from getting sunlight and hence die when food in seed reserves is depleted. Cover crops also modify the heat wave amplitude thereby improving the soil microclimate for crops.
Justification	Tomato is an important crop for food, nutrition security and income generation in Kenya. A wide range of weed species limit production. These weeds are hosts to numerous pests increasing cost of production. Most farmers do hand weeding but labour is expensive and limited. Weeds difficult to manage such as couch grass and sedges can be easily controlled by use of cover crops resulting in reduced production costs and increasing profitability of economically viable tomato enterprise.
Region promoted	All counties growing tomatoes
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers
Approaches used in dissemination	Sharing knowledge and experiences, Trainings to farmers, farmer participatory demonstrations/farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	-Sustained demand for effective weed control methods -Favorable climatic conditions for tomato production -Availability of cover crops technology -Collaboration between all partners

Partners/stakeholders for scaling up and their roles	KALRO, JKUAT and KU will conduct trials and research on trap crops and their effectiveness under pest/pathogen hotspots; County governments, Farmer Groups/CBOs and NGOs will implement extension.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	All counties growing tomatoes
Counties where TIMP will be upscaled	Kajiado, Siaya, Elgeyo Marakwet, Garissa, Mandera
Challenges in dissemination	-Limited knowledge on weeds -Limited knowledge on cover crops. -Limited resource personnel.
Suggestions for addressing the challenges	- Sharing of knowledge on cover crops and weeds - Training on weeds biology. - Training and demonstration on cover crop technology management. - Economic analysis to convince growers on cost effectiveness
Lessons learnt in upscaling, if any	The current mindset and dependence on manual weeding is based on lack of knowledge on other weed management options and training on cover crops technology can contribute to increased yields and quality of healthy tomato.
Social, environmental, policy and market conditions necessary for development and upscaling.	-Favorable climatic conditions for tomato production. -Sustained market demand for high quality tomato fruits.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	To be determined
Estimated returns	KES depends on varieties grown per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women have limited access to agricultural information and extension services so they might not be aware of the importance of Cover cropping for maize weed management</li> <li>• Gender disparities in access to information may impact on adoption decisions</li> <li>• Women have got limited access to funding as compared to men so they might not have finances to purchase seeds used for cover crop</li> <li>• Men dominate in decision making of the farm enterprises in many communities</li> <li>• Land ownership is mainly by men who may have no interest in tomato farming</li> <li>• There is slow information and awareness flow to female farmers due to their low academic levels.</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• The cover crop for tomato weed management offers good opportunities to both men and women to grow diverse crops for economic gains and at the same time offers enhanced biodiversity benefits</li> </ul>

	<ul style="list-style-type: none"> <li>• The TIMP has the potential of increasing employment for women and youth</li> <li>• The TIMP has the potential of increasing food security for families</li> <li>• Cover cropping system can result in reduced labour which could have positive impact on the women who are key players during planting and weeding</li> <li>• Need to train especially women on how to implement the cover cropping systems</li> <li>• Diversity and yield stability are a major win for the entire household in terms of increased income which improves livelihoods</li> </ul>
Vulnerable Marginalized Groups (VMG) issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Cover cropped systems may require specialized implements for direct planting</li> <li>• The technology may reduce VMGs work burden when it comes to weeding</li> <li>• VMGs have limited access to agricultural information, technology and knowledge</li> <li>• VMGs have limited access to land for tomato cultivation</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• System diversification and yield stability will increase food availability leading to food and nutrition security at House hold level</li> <li>• Improved income from production and marketing of tomato and other cover crops gives diversified incomes.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Work done using cover crops for weed control in KALRO-Kabete.
Application guidelines for users	<b>Guidelines are needed</b>
<b>F: STATUS OF TIMP READINESS</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara; KALRO - Kabete.
Lead organization and scientists	KALRO: Dr Hottensiah Mwangi, Dr J. Maina., Agnes Ndegwa, Rebecca Faraay
Partner organizations	MoALF&C, County governments.

### Research gaps

- To identify appropriate cover crops for managing weeds e.g. allelopathic crops such as mucuna, rye, etc.

<b>2.7.4 TIMP Name</b>	<b>Biodegradable mulching material</b>
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Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	-High incidence of a wide biodiversity of weeds -Limited knowledge on biology of weeds -Inappropriate and unsustainable methods used to control weeds.
What is it? (TIMP description)	This is the method where weeds are managed using available biodegradable materials to suppress emerging weeds by acting as physical barriers; cutting light so the already germinated weeds die after using food reserved in seeds. These materials include organic mulches such as banana leaves, and grass.
Justification	Tomato is an important crop for food and nutrition security; employment and, income generation in Kenya. A wide range of weed species limit production. Most farmers do hand weeding which is tedious, expensive and labour is not readily available. Mulching is a labour-saving practice that can be used to manage weeds.
Region promoted	All counties growing tomatoes
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, researchers and extension agents
Approaches used in dissemination	Training farmers, farmer using participatory demonstrations/ farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	-Understanding biology of the biodiversity of weeds -Sustained demand for effective weed control methods -Favorable climatic conditions for tomato production -Availability of biodegradable materials. -Collaboration between all partners
Partners/stakeholders for scaling up and their roles	KALRO - share knowledge, skills and experiences. County governments/Extension will mobilize farmers to collaborate. Farmers will provide land and participate in experimentation to validate and scale up. CBOs and NGOs to collaborate in up-scaling efforts.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	All counties growing tomatoes
Counties where TIMP will be upscaled	Kajiado, Siaya, Elgeyo Marakwet, Garissa, Mandera
Challenges in dissemination	-Limited resources- personnel -Limited understanding of the weeds to help in making informed decision on weed management. -The current mindset and dependence on manual weeding is due to lack of knowledge, skills on weeds limiting options to hand weeding in tomato

Suggestions for addressing the challenges	-Develop knowledge and capacity of farmers on weeds biology. -Training and demonstration on appropriate and timely weed management options. -Economic analysis to convince growers on cost effectiveness
Lessons learnt in upscaling, if any	-Understanding the weeds helps in making informed decision of weed management. -The current mindset and dependence on manual weeding is based on lack of knowledge, skills on weeds and the options to manage effectively for producing healthy tomato
Social, environmental, policy and market conditions necessary for development and upscaling.	-Favorable climatic conditions for tomato production -Sustained market demand for high quality tomato fruits.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	To be determined
Estimated returns	KES – (depends on variety )per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The practice uses remnants from previous crops/ plants that may offer competition in terms of fuel wood and livestock thus bringing a conflict those performing the specific tasks, e.g. women in case of fuelwood and men for livestock feed. This will negatively affect the adoption and scaling up</li> <li>• The technology may reduce women work burden when it comes to weeding</li> <li>• Women and youth have limited access to land for maize cultivation</li> <li>• Women have less access to agricultural information, technology and knowledge</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women who mainly perform the weeding tasks will get a relief and spend their efforts elsewhere</li> <li>• Improved productivity will benefit both gender in terms of higher earnings</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Though easy to use, it is labour intensive for VMGs, hence its adoption and scaling up is a challenge for them</li> </ul>
VMG related opportunities	Mulch is locally available on-farm, and thus has very low costs implying that all including VMGs can take advantage of the practice
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Research work done using grass mulches for weed management in tomatoes (CAL-J varieties) at KALRO Kabete.
Application guidelines for users	Guidelines are needed

<b>F: STATUS OF TIMP READINESS</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara; KALRO Kabete
Lead organization and scientists	KALRO: Dr Hottensiah Mwangi, Dr J. Maina, Agnes Ndegwa.
Partner organizations	MoALF&C and County governments.

### Research gaps

To test available materials in different regions (i.e. region-specific trials)

<b>2.7.5 TIMP Name</b>	<b>Biological control</b>
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	-High incidences of weeds -Wide variety of weed species -Limited knowledge on weed species -Inappropriate and inefficient methods used to control weeds.
What is it? (TIMP description)	Biological methods of weed control include: -Allelopathic plants -Mulch e.g. bio-degradable crop residues -Fertility manipulation -IWM common practices suitable for land. This involves combination of two or more of the above compatible methods to control weeds
Justification	Tomato is an important crop for food, nutrition and income security in Kenya. A wide biodiversity of weed species occurs and limits production. Most farmers do hand weeding, but labour is expensive and limited. Biological weed control methods can be used to alleviate this problem for tomato farmers increase yield, and profitability.
Region promoted	All counties growing tomatoes
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers
Approaches used in dissemination	Training farmers, Participatory technology demonstrations/ farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	-Sustained demand for effective weed control methods -Favorable climatic conditions for tomato production -Collaboration between all partners

Partners/stakeholders for scaling up and their roles	KALRO, will conduct trials and research on biocontrol of weeds and their effectiveness County governments/Extension, Farmer Groups/CBOs and NGOs will implement extension.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	All counties growing tomatoes
Counties where TAMP will be upscaled	Kajiando, Siaya, Elgeyo Marakwet, Garissa, Mandera
Challenges in dissemination	-Limited resource personnel
Suggestions for addressing the challenges	- Share knowledge and build TOT Capacity on weeds biology and ecology. -Training and demonstration on appropriate timely weed management -Economic analysis to convince growers on cost effectiveness
Lessons learnt in upscaling, if any	The current mindset and dependence on manual weeding to produce healthy tomato needs to be addressed.
Social, environmental, policy and market conditions necessary for development and upscaling.	-Favorable climatic conditions for tomato production -Sustained market demand for high quality tomato fruits.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	To be determined
Estimated returns	KES – (depends on tomato variety ) per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited knowledge on biological weed control in maize due to lack of access to agricultural information and extension services</li> <li>• Most of the decisions relating to the crop health and control are done by men as the head of the households for those who are married</li> <li>• Most of the women are semi-illiterate and they might not have adequate skills so they might not understand the protocols written on Biological control method information pamphlet</li> <li>• Biological control method for maize is cheap and reduces production costs therefore user friendly to poor women</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Adoption of biological control methods for maize will lead to improved productivity of maize hence more income for women</li> <li>• Adoption of biological control methods for maize will also lead to increased food security and nutrition for households</li> </ul>

	<ul style="list-style-type: none"> <li>• Biological control methods adoption will lead to employment opportunities for women and youth at various nodes of tomato value chain</li> <li>• There will also a reduction of cost of production for women if biological control methods for maize is adopted</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited access to productive resources such as land, credit, and quality seeds</li> <li>• VMGs have limited access to training and extension services</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> <li>• VMGs have limited access to agricultural information and extension so they might not be aware of Biological control method for maize</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• The technology can improve food and nutrition security for VMGs</li> <li>• Adoption of IPM of biological control methods in maize will lead to improved productivity of maize hence more income for VMGs</li> <li>• Biological control adoption will lead to employment opportunities for VMGs at various nodes of tomatoes value chain</li> <li>• There will also a reduction of cost of production for VMGs if biological control method for maize adoption is adopted</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	
Application guidelines for users	Guidelines are needed
<b>F: STATUS OF TIMP READINESS</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires further research
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara; KALRO Kabete JKUAT
Lead organization and scientists	KALRO: Hottensiah Mwangi, Dr J. Maina, Agnes Ndegwa.
Partner organizations	MoALF&C, County governments, Universities: KU, JKUAT

### Research gaps

<b>2.7.6 TIMP Name</b>	<b>Tomato varieties resistant to parasitic weeds</b>
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Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>- Parasitic weeds on tomatoes such as <i>Orobanche species</i>.</li> <li>-Limited knowledge on weeds parasitic to tomatoes.</li> <li>-Inappropriate methods used to control parasitic weeds</li> </ul>
What is it? (TIMP description)	<p>This involves growing of varieties resistant or tolerant to parasitic weeds such as <i>Orobanche Cumana</i>, <i>O. cernua</i> and <i>O. minor species</i>.</p> <p>These varieties are capable of producing at least reasonable yield despite infestation by the <i>Orobanche</i> spp. compared to the susceptible varieties that will produce nothing under <i>Orobanche spp.</i> infestation.</p>
Justification	<p>Tomato is an important crop for food, nutrition and income security in Kenya. A wide range of weeds grow in tomato production. These weeds are hosts to numerous pests increasing cost of production. Parasitic weeds specifically attach on the roots, suck nutrients resulting to stunted growth and sometimes wilting. In Kenya Dodder (<i>C. campestris</i>) is widespread at 1370 – 3000m altitude. Field dodder is a parasitic plant that attaches to the stems and leaves of broadleaf plants; including weeds, field crops, vegetables, fruits and ornamentals in most agricultural regions of the world. It is the most important of the dodders because of its wide host range which increases chances of contamination and hence introduction to new areas over both short and long distances. Vegetative spread can be very rapid, upto 5m in 2 months. It also has a wide tolerance to changes in climatic conditions from warm temperate to sub-tropical and tropical. Most farmers turn to manual weeding but damage is already and hence yield losses incurred. Identification and use of varieties that can tolerate invasion by parasitic weeds is an effective management option.</p>
Region promoted	Ethiopia
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers
Approaches used in dissemination	Trainings to farmers, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>-Sustained demand for effective weed management methods</li> <li>-Favorable climatic conditions for tomato production</li> <li>-Collaboration between all partners</li> </ul>

Partners/stakeholders for scaling up and their roles	KALRO, MOAL&F will conduct trials and research on tomatoes varieties resistant to Orobanche species. County governments/extension, farmers' groups/CBOs and NGOs will implement.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Not known
Counties where TIMP will be upscaled	Kajiado, Kisumu, Siaya, Elgeyo Marakwet, Garissa, Mandera and others
Challenges in dissemination	-Limited knowledge and skills in management of parasitic weeds, -Limited number of weed experts to advise farmers on management issues using resistant varieties
Suggestions for addressing the challenges	-Train TOT -Provision of knowledge on resistant tomatoes -Training and demonstration on resistant tomato crops -Economic analysis to convince growers on cost effectiveness
Lessons learnt in upscaling, if any	The current mindset and dependence on available varieties susceptible to parasitic weeds.
Social, environmental, policy and market conditions necessary for development and upscaling.	-Favorable climatic conditions for tomato production -Sustained market demand for high quality tomato fruits.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	To be determined
Estimated returns	KES depending on varieties
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited access to education, training and extension services</li> <li>• Women have less access to agricultural information, technology and knowledge</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• There is need to sensitize both men and women on value of crop losses caused by parasitic weed competition on tomato, since women and children are the main sources of labour for this crop.</li> <li>• Adoption of technology will reduce the labour burden on women and children, the children can get time for school work, while the women can engage in other economic activities</li> <li>• Women stand to benefit in increased production due to timely operations, increased yields and sales and thus improved livelihoods</li> <li>• Any gender can use tomato varieties resistant to parasitic weeds in tomato production and marketing which increases opportunities for income</li> </ul>
Vulnerable Marginalized Groups (VMG)issues and concerns in	<ul style="list-style-type: none"> <li>• Due to prejudice associated with their social status, VMGs are excluded from</li> </ul>

development, dissemination, adoption and scaling up	<p>accessing benefits from improved technologies</p> <ul style="list-style-type: none"> <li>• VMGs have limited access to productive resources such as land and credit</li> <li>• Women and youth have limited access to education, training and extension services</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Affirmative action is thus required to promote tomato Varieties Resistant to parasitic weeds to the VMGs. This will lead to enhanced production by VMGs</li> <li>• Use of Tomato Varieties Resistant to parasitic weeds will improve on weed management leading to increased productivity, increase availability of tomato for consumption which will improve food security hence improved health of VMGs</li> <li>• Increased production of tomato will lead to economic empowerment of VMGs</li> <li>• VMGs can utilize the practice as they engage in different parts of the tomato value chain.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	
Application guidelines for users	<b>Guidelines are needed</b>
<b>F: Status of TIMP readiness</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires further research
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara & KALRO Kabete.
Lead organization and scientists	KALRO: Dr Hottensiah Mwangi and Dr J. Maina.
Partner organizations	MoALF&C, County governments.

### **Research gaps:**

<b>2.7.7 TIMP Name</b>	<b>APDC Approach</b> 1.0 Awareness, 1.1 Prevent, 1.2 Detect, 1.3 Control 1.3.1 Surveillance, 1.3.2 quarantine.
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	-Incidence of invasive weed species on tomatoes. -Limited knowledge on invasive weeds species such as dodders ( <i>Cuscuta campestris</i> ), <i>Orobanche cernua spp.</i> )

	-Ineffective, inefficient and unsustainable methods used to control invasive parasitic species.
What is it? (TIMP description)	<p>This is use of the Awareness, Prevention, Detect, Control (APDC), Surveillance and Quarantine of parasitic weeds control depending on the severity of weed pressure. Producers must have awareness of the invasive parasitic weeds, applying preventive measures by sowing certified seeds, and or controlling present weeds. Herbicides can be used to control weeds before planting (pre emergence herbicides). Pre-emergences are applied on to moist soil after field preparation and planting before both crop and weed have emerged. A pre-emergence should be selective for tomato so as not to affect the crop when applied. This can be followed by mulching to stop further infestation by weeds. Post emergence is applied on the actively growing weeds. Non selective, broad spectrum; Are applied as recommended in the label, mostly used in zero and minimum tillage.</p> <p>(a) Spot spray application. Boom application. Low rates of Glyphosate should be added for seedset suppression from September onwards</p> <p>(b) Non selective, broad spectrum; Are applied as directed or guarded with a hood to avoid harming the crop, mostly used in zero and minimum tillage.</p>
Justification	To handle the complex invasive weed species problems in tomato production, a holistic line of action with multi-disciplinary approaches is used to bring together members of Invasive Weeds Technical Working group and other people who share a common goal with CABI Global programme on Action on Invasive species (AoI) which, focuses on strengthening national systems to create awareness on any identified invasive species, prevent, eradicate, control and manage Invasive Species. Therefore, to control the spread of invasive weeds species, stakeholders should regularly be following the APDC steps to address to the threat of invasive species. Tomato is an important crop for food, nutrition security and income generation in Kenya. Most growers use hand weeding; but, this is not effective for parasitic weeds control hence the need to apply the APDC on parasitic weeds identified
Region promoted	All counties where invasive weeds are a priority
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers
Approaches used in dissemination	APDC

	<p><b>1.0 Awareness, 1.1 Prevent,</b>  1.1.1. Ensure the planting material of the crop plant is clean (not contaminated with the field dodder).  1.1.2. Removal of highly favored hosts such as field bindweed (<i>Convolvulus arvensis</i>) from around the field edges is recommended.  <b>1.2 Detect,</b>    <b>1.3 Control</b>  Physical/Mechanical Control  The young seedlings of the field dodder with its primary roots can be destroyed before they get out of control. This can be done by careful tillage or hand-pulling when infestations are still scattered, in order to avoid removal of the infested crop plant with the field dodder.  1.3.1 Surveillance,  1.3.2 Quarantine priority invasive species</p>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>-Building tomato producers capacity to understand the biology of invasive weed species.</li> <li>-Sustained demand for effective weed control methods</li> <li>-Favorable climatic conditions for tomato production</li> <li>-Collaboration between all partners</li> </ul>
Partners/stakeholders for scaling up and their roles	<p>KALRO will conduct management trials of parasitic invasive species in hotspots;  County governments and extension, farmer groups/CBOs, and NGOs will implement extension.</p>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	All counties growing tomatoes
Counties where TIMP will be upscaled	Kajiado, Siaya, Elgeyo Marakwet, Garissa, Mandera
Challenges in dissemination	<ul style="list-style-type: none"> <li>-Limited knowledge on weeds</li> <li>-Limited resource personnel</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>- Create awareness,</li> <li>- Share knowledge of parasitic weeds ecology and biology.</li> <li>- Training on weeds identification.</li> <li>-Training and demonstrate on mechanical hand control.</li> <li>-Economic analysis to convince growers on cost effectiveness</li> </ul>
Lessons learnt in upscaling, if any	The current mindset and dependence on manual weeding to produce healthy tomato does not address parasitic weeds.
Social, environmental, policy and market conditions necessary for development and upscaling.	<ul style="list-style-type: none"> <li>-Favorable climatic conditions for tomato production.</li> <li>-Sustained market demand for high quality tomato fruits.</li> </ul>

<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	To be determined
Estimated returns	KES depends on varieties grown per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Tomato production is labour intensive with weeding mainly being done by women and is likely to consume a lot of productive hours. APDC adds the workload of women which is already complicated by the multiple roles they play in the households</li> <li>• Women and youth have limited access to production resources such as land, capital to purchase herbicides</li> <li>• Women have less access to agricultural information and extension so they might not have any knowledge on APDC in tomato</li> <li>• Women might not be able to read and understand the protocols and dissemination material written on APDC due to illiteracy</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• There will be creation of jobs for women and youth in agro-vet shops increasing income for them</li> <li>• Increased tomato production leading to improved food security and nutrition from for women</li> <li>• There will be increased job security for men and youth for spraying herbicides</li> <li>• Use of APDC technology can reduce labour from manual weeding and save time for other activities for women</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Weeding in tomato farms is labor intensive for VMGs to undertake</li> <li>• VMG groups could have limitations in accessing the technology due to limited access to agricultural information and extension</li> <li>• VMGs have no funds and resources to purchase herbicides due to limited access to credit facilities.</li> <li>• VMGs might be able to read and understand the protocols and dissemination material written on APDC due to high illiteracy levels</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• APDC technology can create employment for VMG at various nodes of the value chain</li> <li>• There in potential of increased production of tomato which will lead to increased food security and nutrition</li> </ul>

	<ul style="list-style-type: none"> <li>There will be increased supply of tomato to the markets for VMGs hence increased incomes</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Work done on herbicide weed control in KALRO-Kabete.
Application guidelines for users	Guidelines are needed
<b>F: STATUS OF TIMP READINESS</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara; KALRO - Kabete.
Lead organization and scientists	KALRO: Dr Hottensiah Mwangi, Dr J. Maina.
Partner organizations	MoALF&C, County Governments.

<b>2.7.8 TIMP Name</b>	<b>Use of herbicides</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>-High incidence of difficult weeds to control</li> <li>-Limited knowledge on weeds</li> <li>-Inappropriate, inefficient and unsustainable methods used to control weeds.</li> </ul>
What is it? (TIMP description)	<p>Herbicide technology is use of chemicals for controlling weeds. They are divided into pre-emergence and post emergence herbicides depending on time of application.</p> <ul style="list-style-type: none"> <li>i) Pre-emergences are applied on to moist soil after field preparation and planting before both crop and weed have emerged.</li> <li>ii) Post emergence are applied when both the crop and the weed are actively growing, these are divided into: <ul style="list-style-type: none"> <li>(a) Selective: These will not harm the crop when applied</li> <li>(b) Non selective, broad spectrum; Are applied as directed or guarded to avoid harming the crop, mostly used in zero and minimum tillage</li> </ul> </li> </ul>
Justification	Tomato is an important crop for food, nutrition security and income generation in Kenya. A wide range of weed species limit production. These weeds harbor numerous pests increasing cost of production. Most farmers do hand weeding but labour is expensive and limited. Weeds difficult to manage such as couch grass and sedges will be controlled by using recommended herbicides rates.
Region promoted	All counties growing tomatoes
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers

Approaches used in dissemination	Trainings to farmers, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, electronic platforms
Critical/essential factors for successful promotion	-Sustained demand for effective weed control methods -Favorable climatic conditions for tomato production. -Collaboration between all partners
Partners/stakeholders for scaling up and their roles	KALRO, JKUAT and KU will conduct trials and research County governments, farmers' groups/CBOs, and NGOs will implement extension.
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	All counties growing tomatoes
Counties where TIMP will be upscaled	Kajiado, Siaya, Elgeyo Marakwet, Garissa, Mandera
Challenges in dissemination	-Limited resource personnel.
Suggestions for addressing the challenges	- Provision of knowledge and training on weeds biology. -Training and demonstration on appropriate timely weed management using herbicide. -Economic analysis to convince growers on cost effectiveness
Lessons learnt in upscaling, if any	The current mindset on herbicide weeding to produce healthy tomato needs to be addressed.
Social, environmental, policy and market conditions necessary for development and upscaling.	-Favorable climatic conditions for tomato production. -Sustained market demand for high quality tomato fruits.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	To be determined
Estimated returns	KES - per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women perform most of the weeding activities therefore use of herbicides will reduce their work burden</li> <li>• Women and youth have limited access to productive resources such as land and chemicals</li> <li>• Women and youth have limited access to education, training and extension services</li> <li>• Women have less access to agricultural information, technology and knowledge</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women and children are the main sources of labour for this tomato. Adoption of use of herbicides will reduce the labour burden on women and children.</li> <li>• The children can get time for school work, while the women can engage in other economic activities.</li> <li>• Women stand to benefit from increased yields and sales due to timely weed control.</li> <li>• Employment opportunities exist for youth males and men in spraying</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• This is a knowledge intensive innovation especially the configurations. Training is key for men, women and the youth.</li> </ul>

	<ul style="list-style-type: none"> <li>• Due to prejudice associated with their social status, VMGs are excluded from access to benefits from improved technologies. Thus, affirmative action is required to promote tomato crop for the VMGs</li> <li>• VMGs have limited access to productive resources such as land, credit and chemicals.</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Timely operations will lead to enhanced production by VMGs</li> <li>• Employment opportunities exist for youth males and men in spraying</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	
Application guidelines for users	<b>Guidelines are needed</b>
<b>F: STATUS OF TIMP READINESS</b> (Ready for upscaling; 2. Requires validation; 3. Requires further research)	<b>Requires validation</b>
<b>F: Contacts</b>	
Contacts	Director, KALRO Kandara and KALRO-Kabete
Lead organization and scientists	KALRO: Dr Hottensiah Mwangi, Dr J.Maina, Agnes Ndegwa, Rebecca Faraay
Partner organizations	MoALF&C, County governments.

## Gaps

<b>2.7.9 TIMP Name</b>	<b>Safe Use of Herbicides</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Misuse of herbicides, methods, use of herbicides wearing the right protective clothing, storage of herbicides in-designated stores, wrong application techniques, spraying at the wrong times and against the wind direction, use of pesticides without following the guidelines provided on the labels. Inadequate enforcement of global policies and regulation on use of herbicides. Environmental, health and social concerns.
What is it? (TIMP description)	Capacity building of farmers, crop protection teams and stakeholders on safehandling and use of herbicides right from the dealers, transportation and application in the field.

	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. The technology will include proper methodologies for proper pesticide disposal to minimize pollution of the environment.
Justification	Although cases of improper use of herbicides are very common in most of the areas 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 and stakeholdersto be made aware of the best practices that should be used whenhandling pesticides. There has been reports of increase of chronic diseases in human beings. Hence it is important to build stakeholders with this TIMP.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Producers, transporters and stakeholders
Approaches used in dissemination	Farmer trainings, farmer participatory demonstrations/ farmer field schools, shows, trade fairs, Plant clinics, Herbicide spray Demonstrations
Critical/essential factors for successful promotion	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"> <li>• Ministry of Agriculture-Extension Service to conduct extension services and farmer trainings</li> <li>• Individual Farmers farmergroups/CBOs to participate in the implementation in the field.</li> <li>• KALRO and Universities to develop the technologies and conduct ToTs. CABI, AAK, PCPB, KEPHIS</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where technology is already being promoted if any	Kajiado, Garrisa, Mandera, Muran'gga and Kirinyaga.
Counties where TIMPS will be up scaled	Nyeri Nakuru, TransNzoia, Kakamega, Bungoma, Machakos, Makueni, and Laikipia.
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Change of mindset in favour of current practices maybe difficult to achieve,</li> <li>• Illiteracy and inadequate capacity to use pesticides correctly. Most farmers cannot read and interpret the labels properly resulting to overuse or underuse of herbicides.</li> <li>• Use of banned pesticides from neighboring countries</li> <li>• Inadequate capacity by farmers and agrochemical companies to dispose pesticides properly</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Capacity building and sensitization forums for both farmers and agro dealers using participatory approach</li> <li>• Formation of youth spray teams</li> </ul>

	<ul style="list-style-type: none"> <li>• Establishment of aggregation centres for pesticide containers</li> <li>• Establishment of training of Extension staff and lead farmers as TOT</li> <li>• Increase surveillance along the border points and enforce the law.</li> </ul>
Lessons learned in upscaling if any	<p>Upscaling of this technology needs all to be trained for the safety of all and our planet. ie health of users, social hazards-cost resulting to disease emanating from misuse of herbicides, and for environmental hazardous nature.</p> <p>Some of the aspects of this technology need a lot of capital to actualize. For instance, the collection and incineration of pesticide containers needs a lot of money that may not be accessible by most farming communities, men or youth groups. The illiteracy levels of some farmers may hinder the use of correct information/knowledge in the use of herbicides in some areas.</p>
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 60,000 per acre
Estimated returns	KES 500, 000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Herbicides are not safe for use by expectant women and the physically challenged individuals. They are not allowed to do spraying because of hazardous/ dangerous nature of herbicides.</li> <li>• Herbicides and protective gear are expensive and most women may not afford them</li> <li>• Lack of knowledge by men and women on the dangers of herbicides especially on storage and disposal</li> <li>• Low levels of illiteracy and inability to read and interpret the content of the herbicide labels especially on re-entry period after spraying and PHI. This can cause herbicides poisoning.</li> <li>• Herbicides are expensive for most youths and women may not afford them</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Formation of spray teams by men and youths</li> <li>• Formation of surveillance/ scouting groups by women</li> <li>• Safe use of herbicide can easily be undertaken by the youth as an enterprise by forming spray teams in the wards for calibration spraying services at a fee</li> <li>• Youths can help in the collection of pesticide containers and assist in the incineration processes coordinated by AAK (Crop life Kenya) at a fee</li> <li>• Youth to own and operate agro chemicals that stock the right pesticides and offer advisory services to farmers at the agrovet shop</li> <li>• Youths to offer spray calibration services to farmers as an enterprise.</li> </ul>

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Herbicides are dangerous products that may not be handled by vulnerable groups</li> <li>• Herbicides are expensive for most physically challenged groups that may not utilize them</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• VMGs to offer spray calibration services to farmers as an enterprise</li> <li>• VMGs to help in the collection of pesticide containers and assist in the incineration processes by AAK</li> <li>• VMGs to own and operate agro chemicals that stock right pesticides and offer advisory services to farmers at the agrovet shops</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	<ul style="list-style-type: none"> <li>• 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 pesticides</li> <li>• Some counties who have aggregation centres by AAK for collection of pesticide containers. This has led to reduction of these containers on farms</li> <li>• Safe use of Pesticide campaigns by AAK, PCPB KALRO and MOLFI have</li> </ul>
Application guidelines for users	<ul style="list-style-type: none"> <li>• Sensitization of farmers on the harmful effects of the pesticides on human beings and environment.</li> <li>• Capacity build farmers and youth on spraying techniques using developed curriculum by AAK and PCPB. Assist youth to form spraying teams and equip them with PPEs.</li> <li>• Train Extension staff as Plant doctors using the CABI modules, manuals and establish Plant Clinics in the target counties. Develop and equip youth spraying teams with pest decision guidelines, manuals, brochures developed by KALRO and CABI as reference material.</li> </ul>
Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. requires further research)	Ready for upscaling
<b>F: Contacts</b>	
Contacts	Centre Director KALRO Kabete
Lead organization and scientists	KALRO: Dr Hottensiah Mwangi, Dr Jedidah M. Maina and Charity W. Muchira.
Partner organizations	MoALFI&I, CABI, PCPB, AAK, KEPHIS, County Governments, Universities

## 2.8 Good Agricultural Practices and Food Safety Management System

2.8.1 TIMPs name	Good Agricultural Practices (GAP)
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Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Detection of food contaminants in both fresh produce, including Tomato, has been rampant. This results in declining food safety and quality, therefore frustrating sustainable farming of these crops for both food and income generation. Most markets continue to impose more stringent measures (to ensure the safety of consumers) for those wishing to access the said markets. These contaminants also impact negatively on the environment, worker safety and health; and consequently making it difficult to implement traceability, as most producers do not give accurate information on inputs and processes used during production, to avoid commercial losses and even prosecution
What is it? (TIMP description)	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). 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. Commercialization of Tomato on the domestic and future export level highly depends on compliance to these market standards
Justification	There is need to arrest the rampant detection of food contaminants in Tomato. Good Agricultural Practice(s) (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 by ensuring safety throughout the food chain. It needs to be enforced and transparent, not only from the table but also upstream to include suppliers (e.g. quality of fertilizers and plant protection products) and all the value chain players including providers of logistics and farm equipment
<b>B: Assessment of dissemination and scaling up/out approaches</b>	

Users of TIMP	All 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	FFBS, On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, and larger plot demonstrations.
Critical/essential factors for successful promotion	Policy support from government particularly the enforcement of KS1758 (a domestic scope standard that has been passed after undergoing public participation stage).
Partners/stakeholders for scaling up and their roles	Producer organizations (FPEAK, FPC, KFC, AGAK etc), NGO's, MOALID, Private extension providers, CoG, and other value chain players
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Already promoted in Meru, Embu, Nyeri, Nyandarua, Muranga, Embu, Kirinyaga, Kisii, Uasingishu, Nakuru, Kericho, Bomet and other horticultural hot spots
Counties where TIMP will be up scaled	All counties in Kenya particularly where Tomato is grown
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Lack/inadequate knowledge on the benefits GAPs</li> <li>• Lack of legislative mechanisms to support the GAP, in particular the domestic scope</li> <li>• The perception that GAP is oppressive rather than supportive</li> </ul>
Recommendations for addressing the challenges	Continuous training of farmers, extension staff and other value chain players
Lessons learned in up scaling, if any	The low number of stakeholders aware of GAP
Social, environmental, policy and market conditions necessary	Supportive policy of national and county governments to promote adaption of GAP's.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Difficult to put monetary gains figures as most involves social and welfare issues in addition than markets lost due to non-compliance
Estimated returns	Benefits are mostly social welfare issues in addition to additional markets accessed
Gender issues and concerns in development, dissemination adoption and scaling up,	<ul style="list-style-type: none"> <li>• Women and youth have less access to factors of production like land and credit</li> <li>• In most households, it is the men who make decision on what to do and how it is done <ul style="list-style-type: none"> <li>▪ Women may not have time and mobility to attend trainings and other extension activities far from home or held at times when they are performing</li> </ul> </li> </ul>

	<p>other domestic roles</p> <ul style="list-style-type: none"> <li>▪ Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles</li> <li>▪ Women might not be aware of GAPs due to their low level of education and the social economic status</li> <li>▪ There is need for all the stakeholders to be sensitized in GAPs to achieve good profits from their Tomato products</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Agro-enterprise development by youth, females and males based on GAPs</li> <li>• Increased income due to improved income as a result of using GAPs by the youth, females and males</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have less access to GAPs as they are not given chances to participate in agricultural trainings and workshops</li> <li>• VMGs have less access to farmer organization</li> <li>• VMGs have less access to farm implements VMGs have limited access credit to purchase the required GAPs</li> <li>• VMGs have limited access to training on GAPs and extension services</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination of GAPs</li> <li>• There is low adoption by VMGs due lack of awareness</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Agro-enterprise development by VMGs based on GAPs</li> <li>• Increased income due to improved yield because of using GAPs, market access for the VMGs</li> <li>• Increased employment for VMGs and improved food security</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	<p>Small, holders in groups in the counties of Kirinyaga, Nyeri, Meru, Nakuru and other counties have been able to produce and export produce from horticultural crops that are certified after adopting and complying with GAP's.</p>
Application guidelines for users	<ul style="list-style-type: none"> <li>• Global GAP Version 6 (Code Ref: IFA V5.2_Feb19; English Version Versionn /Edition Update Register Page: 45 of 45) - <a href="https://www.globalgap.org/.content/.galleries/documents">https://www.globalgap.org/.content/.galleries/documents</a></li> <li>• KALRO-USAID Training And Extension</li> </ul>

	Manual On Good Agricultural Practices (Gap) - Nov. 2017
<b>F: Status of TIMP readiness (1. Ready for upselling; 2. Requires validation; 3. Requires further research</b>	Ready for up scaling
<b>G: Contacts</b>	
Contacts	<ul style="list-style-type: none"> <li>• Director, KALRO Seed –Thika; info.kalroseeds@kalro.org</li> <li>• Centre Directors; KALRO Kandara,</li> <li>• KALRO NSRC;</li> <li>• Director General KALRO</li> </ul>
Lead organization and scientists	KALRO: Nyaga A., Ndungu J., Gatambia E., Kambo C., Kuria, S Musyoki R. Wasilwa, L., Kirigua, V., Muriuki SJN.
Partner organizations and their roles	MoALF&I, AFA, FPEAK, FPC, PCPB, AAK, KEPHIS, County governments, NGO’s, Universities

<b>2.8.2 TIMP Name</b>	<b>Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for Tomato Value Chain in Kenya</b>
Category (i.e. technology, Innovation or management practice)	Management Practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<p>The presence of chemical, biological and physical hazards within the Tomato value chain in Kenya have a direct effect on consumer’s health. There is increasing demand for high quality of the crop and other products where it is incorporated, from consumers and public health departments in counties.</p> <p>The biological contaminations previously reported on this value chain include presence of <i>Escherichia coli</i> (E. coli), <i>Salmonella</i> spp., <i>Aspergillus flavus</i> and <i>Aspergillus parasiticus</i>. The chemical hazards are mainly due to heavy metal presence such as lead/mercury/cadmium; while exceedance of MRLs been reported. These hazards are suspected to cause neurological disorders, cancer and birth defects.</p>

What is it? (TIMP description)	Food safety management system (FSMS) through Hazard Analysis and Critical Control Point (HACCP) in Tomato value chain is a system of food safety monitoring and control based on the systematic identification and assessment of various hazards. It is a preventive, rather than a reactive, tool that places the protection of the Tomato supply from biological, chemical and physical hazards into the hands of food management systems. The system is designed to minimize the risk of food safety hazards by identifying the hazards, establishing controls and monitoring these controls.
Justification	<p>There is increasing demand for high quality of the crop and other products where it is incorporated, from consumers and public health departments in counties.</p> <p>The biological contaminations previously reported on this value chain include presence of Escherichia coli (E. coli), Salmonella spp., Aspergillus flavus and Aspergillus parasiticus. The chemical hazards are mainly due to heavy metal presence such as lead/mercury/cadmium; while exceedance of MRLs been reported. These hazards are suspected to cause neurological disorders, cancer and birth defects.</p> <p>There is need to put in place risk analysis and hazard monitoring and management system to ensure that food contaminants are kept at bay along the Tomato value chain. Presence of these contaminants not only poses serious risks to human health and trade. Such tools are used globally and even adapted by Codex Alimentarius as a global acceptable FSMS. 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 as required. Parameters will be quantified for production, harvesting, processing, distribution and value addition</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato value chain actors from farmers, traders, food vendors and consumers.
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• Training of stakeholders on GAP, Good Manufacturing Practice (GMP) and Good Hygiene Practice (GHP)</li> <li>• Tomato innovation platforms</li> <li>• FFBS sessions</li> <li>• Through common interest groups discussions, field days, exhibitions, radio, TV and social media (Whats App, Facebook, Twitter).</li> </ul>





Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Formation of “experts” team composed of HACCP specialists, food scientists, microbiologists, representative of the Tomato (and other similar crops) value chain players, public health officers, and a quality control and safety specialists from the competent authorities to guide the process</li> <li>• Local and National governments support</li> </ul>
Partners/stakeholders for scaling up and their respective roles.	<ul style="list-style-type: none"> <li>• KALRO, National Agricultural Research Institutes (NARIs) and International research organizations</li> <li>• Market players</li> <li>• Farmers/farmer groups</li> <li>• County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination</li> <li>• NGOs for farmer organizing and mobilization e.g. SACDEP</li> <li>• National competent authorities</li> <li>• Analytical testing services</li> <li>• Processors and local traders</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	<ul style="list-style-type: none"> <li>• Not promoted in any county of Kenya</li> </ul>
Counties where TIMPs will be up scaled	<ul style="list-style-type: none"> <li>• All counties growing and consuming Tomato in Kenya.</li> </ul>
Challenges in development and dissemination	<ul style="list-style-type: none"> <li>• Inadequate funds to reach value chain actors</li> <li>• New concept not very well known among the primary stakeholders and market outlets</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Funding of dissemination platforms</li> <li>• Training of all stakeholders on food safety</li> </ul>
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> <li>• None since scaling up has not been done</li> </ul>
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Tomato being observed by stakeholders as a food and commercial crop that requires protection from contamination</li> <li>• Use of less toxic crop protection methods in handling crop health issues</li> <li>• Establishment of practical and acceptable food handling protocols at both county and National levels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
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"> <li>• Women and youth might not be aware of the existing hazards, their preventive measures and control</li> <li>• Women and youth might to be aware of the impact identified hazards could have to their health</li> </ul>

	<ul style="list-style-type: none"> <li>• In harvesting and processing Tomato to meet the acceptable national standards, women and youth play critical roles.</li> <li>• Therefore, there is need to build the capacity of women and youth in the identifications of food safety hazards/risks and the control measures along Tomato value chain</li> <li>• Women and youth lack finances</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Opportunities exist for women and youth in the marketing and use of Tomato and it's by products as an entrepreneurship.</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited access to production resources such as land, knowledge, information, extension training, and credit and quality seed.</li> <li>• VMGs have limited participation in decision making at community and County level</li> <li>• Require strategies that target the VMG during scaling up of the Tomato value chain.</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Identification of critical limits to be defined</li> <li>• Control measures to be identified</li> <li>• Criteria for compliance already clearly defined for adoption</li> </ul>
○ <b>E: Case studies/profiles of success stories</b>	
Success stories	N/A
Application guidelines for users	<ul style="list-style-type: none"> <li>• HACCP general guidelines - <a href="https://www.fao.org/fao-who-codexalimentarius/codex-texts/codes-of-practice/en/">https://www.fao.org/fao-who-codexalimentarius/codex-texts/codes-of-practice/en/</a></li> <li>• General principles of food hygiene - <a href="https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&amp;url=https%25253A%25252F%25252Fworkspace.fao.org">https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&amp;url=https%25253A%25252F%25252Fworkspace.fao.org</a></li> </ul>
<b>F: Status of TIMP Readiness</b> (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling;
○ <b>G: Contacts</b>	
Contacts	<p>The Institute Director, FCRI Njoro;  Email <a href="mailto:director.fcrinjoro@kalro.org">director.fcrinjoro@kalro.org</a>  The Institute Director, KALRO-HRI Thika; E-mail: <a href="mailto:director.hri@kalro.org">director.hri@kalro.org</a>  Director, KALRO Seeds, E-mail: <a href="mailto:info.ptc@kalro.org">info.ptc@kalro.org</a>  The Centre director, KALRO-Muguga  Email: <a href="mailto:kalro.FCRC@kalro.org">kalro.FCRC@kalro.org</a></p>

	The Centre director, KALRO-Kabete; E-mail: <a href="mailto:cd.narl@kalro.org">cd.narl@kalro.org</a> The Institute director, KALRO-FCRI Kitale; E-mail: <a href="mailto:director.fcric@kalro.org">director.fcric@kalro.org</a>
Lead organization and scientists	<ol style="list-style-type: none"> <li>1. Mr. John N. Ndung'u, FCRI - KALRO Njoro</li> <li>2. Antony Nyaga, KALRO Seeds Thika</li> <li>3. Dr. Francis Wayua, KALRO Kakamega</li> <li>4. Dr. Lusike Wasilwa, Crops Director, KALRO Headquarters</li> <li>5. Mrs. Violet Kirigua, KALRO Headquarters</li> <li>6. Beatrice Wanjiku, KALRO Njoro</li> </ol>
Partner organizations	MoA, AFA, FPEAK, PCPB, AAK, KEPHIS, KEBS, County governments, NGO's and Universities.

## 2.9 Harvest and Postharvest Management


2.9.1 TIMP name	Maturity indices
Category (i.e. technology, innovation or management practice)	Management Practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Reduced productivity due to lack of information and expertise in determination of maturity indices for tomato destined for different markets
What is it? (TIMP description)	This is identification of maturity indices used to determine the appropriate stage to harvest tomato fruit. Tomato maturity indices are assessed through: Visual (size, shape and colour); Texture (firmness and softness); Chemical analysis (sugar content and acid content); and Computation (days from bloom to harvest). Based on colour, four maturity stages are recognized for tomatoes, i.e. breaker, turning, pink and light red:

	Harvest index	Characteristics	Use of Tomato	
	Breaker	10% of the fruits break colour from green to pink or red	Fruits are harvested to send to distant markets	
	Turning	10-30% of pink or red colour	Fruits are harvested for local close markets	
	Pink	30-60% of pink or red colour	Fruits are consumed or used for canning and processing	
	Light red	60-90% of pink or red colour	Fruits are picked for the local market	
Justification	Incorrect timing of harvesting leads to losses of tomato in the field. Harvesting before the maturity of the crop results in lower yields and poor fruit ripening, and rotting in some cases. Delayed harvesting results in losses due to over-ripening of the fruit; and losses caused by pests and diseases. Timely observation of maturity indices and parameters is essential to maximum yield attainment. This ensures good quality of produce with long shelf-life.			
<b>B: Assessment of dissemination and scaling up/out approaches</b>				
Users of TIMP	Farmers, traders, processors and extension service providers			
Approaches used in dissemination	Farmer trainings, Field Demonstrations, Farmer Field Schools, shows, trade fairs, promotional materials (posters, brochures, leaflets, manuals)			
Critical/essential factors for successful promotion	Application of good agricultural practices to have a good crop Increase of productivity per unit Application of harvesting technologies			
Partners/stakeholders for scaling up and their roles	County Government- to provide extension services and funding Seed companies- to provide improved certified seeds and varieties; Individual farmers- to grow and sell tomatoes, Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers – to provide viable all year round markets at good prices that spur growth of the crop			
<b>C: Current situation and future scaling up</b>				
Counties where already promoted if any	Kirinyaga, Tharaka-Nithi, Meru, Kajiado, Trans Nzoia			

Counties where TIMP will be upscaled	Siaya, Elgeyo-Marakwet, Garissa, Mandera, West Pokot
Challenges in dissemination	<p>-Indices are based on visual assessment and this may not be easy for some actors</p> <ul style="list-style-type: none"> <li>• Lack of knowledge on maturity indices and appropriate harvesting technology</li> <li>• Negative attitude by farmers towards adoption of new agricultural TIMPs</li> <li>• Low uptake before the farmers see results</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Awareness creation about the TIMP to farmers and traders</li> <li>• Capacity building of farmers and value chain actors on maturity indices and appropriate harvesting</li> <li>• Availing data on the economics and the gains to be made through adoption of the TIMP</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Involvement of stakeholders such as CBOs and NGOs enhances adoption</li> <li>• Continuous capacity building is key to attitude change.</li> <li>• Consistent trainings, demonstrations and sensitisations would motivate farmers to adopt the TIMP</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Farmers will be willing to adopt the technology</li> <li>• There will be favourable policy for adoption of the technology</li> <li>• Organized marketing channels are critical for benefits to be derived from technology</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Not done
Estimated returns	Reduced losses, better income and nutrition (due to appropriate harvesting indices)
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women have limited access to productive resources such as land, credit facilities and equipment</li> <li>• In the target counties, tomato cultivation is mainly done by women increasing their work burden</li> <li>• Women loss their crops due to late harvesting as a result of being overworked</li> <li>• Women have no finances to pay for hired labor due to limited access to credits</li> <li>• Women are exploited by middle men and brokers due to limited market information and extension</li> <li>• The TIMP is easily adoptable after training and many farmers can use the technology since it reduces losses incurred during and after harvesting.</li> </ul>


Gender related opportunities	<ul style="list-style-type: none"> <li>• The TIMP increases farm income through reduction of postharvest losses.</li> <li>• There is increased employment for women and youth</li> <li>• There is increased food security and nutrition for households</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The practice is suitable for VMGs</li> <li>• Misconceptions about technology may affect adoption and scaling up</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Adoption of the TIMP means reduced postharvest losses,</li> <li>• This will enable VMGs to have enough tomato to consume, hence get macro- and micronutrients (especially vitamins and minerals)</li> <li>• Adherence to recommended maturity indices offers opportunities for lucrative commercial venture, hence more income for VMGs</li> </ul>
<b>E: Case studies/profile of Success stories</b>	
Success stories from previous similar projects	Youth groups in Kiambu, farmers in peri-urban Nairobi County who utilize the appropriate maturity indices have reported improved incomes from adopting the technology
Application guidelines for users	Wayua, F., Ndambuki, J., Ochieng, V. and Wasilwa, L. (2020). Maturity Indices for Tomato. KALRO/KCSAP Programme Factsheet No. #
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Kandara, P. O. Box xx Thika Email: <a href="mailto:kalro.kandara@kalro.org">kalro.kandara@kalro.org</a>
Lead organization and scientists	KALRO: Agnes Ndegwa, Gathambiri Charity, Vincent Ochieng, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.9.2 TIMP name</b>	<b>Harvesting procedure</b>
Category (i.e. technology, innovation or management practice)	Management practices
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Reduced productivity due to incorrect timing of harvest caused by lack of information and expertise in appropriate harvesting practices to maintain tomato quality

What is it? (TIMP description)	<p>This is a management practice involving careful maturity indices, pre-harvest operations, harvesting procedure and use of proper harvesting containers.</p>  <p><i>Harvesting of tomato</i></p>
Justification	<p>Inappropriate harvesting methods leads to losses of tomato in the field. Harvesting before the maturity of the crop results in lower yields and poor fruit ripening, and rotting in some cases. Delayed harvesting results in losses due to over-ripening of the fruit; and losses caused by pests and diseases. Appropriate harvesting methods reduces these losses hence increases tomato productivity.</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, extension service providers
Approaches used in dissemination	Farmer trainings, Field Demonstrations, Farmer Field Schools, shows, trade fairs, promotional materials (posters, brochures, leaflets, manuals)
Critical/essential factors for successful promotion	<p>Application of good agricultural practices to have a good crop  Increase of productivity per unit  Application of harvesting technologies</p>
Partners/stakeholders for scaling up and their roles	<p>County Government- to provide extension services and funding  Seed companies- to provide improved certified seeds and varieties;  Individual farmers- to grow and sell tomatoes,  Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets;  Marketers – to provide viable all year round markets at good prices that spur growth of the crop</p>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka-Nithi, Meru, Kajiado, Trans Nzoia
Counties where TIMP will be upscaled	Siaya, Elgeyo- Marakwet, Garissa, Mandera, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Lack of knowledge on maturity and appropriate harvesting technology</li> <li>• Negative attitude by farmers towards adoption of new agricultural TIMPs</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Continuous capacity building with practical demonstrations</li> <li>• Availing data on economics and the gains to be made through adoption of the TIMP</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Involvement of stakeholders such as CBOs and NGOs enhances adoption</li> </ul>

	<ul style="list-style-type: none"> <li>• Continuous capacity building is key to attitude change.</li> <li>• Consistent trainings, demonstrations and sensitisations would motivate farmers to adopt the TIMP</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Farmers will be willing to adopt the technology</li> <li>• There will be favourable policy for adoption of the technology</li> <li>• The market will be able to absorb saved tomato fruits from reducing harvesting losses</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Not done
Estimated returns	Reduced losses, better income and nutrition (due to appropriate harvesting techniques)
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women have limited access to productive resources such as land, credit facilities and equipment</li> <li>• In the target counties, tomato cultivation is mainly done by women increasing their work burden</li> <li>• Women lose their crops due to late harvesting as a result of being overworked</li> <li>• Women have no finances to pay for hired labor due to limited access to credits</li> <li>• Women are exploited by middle men and brokers due to limited market information and extension</li> <li>• The TIMP is easily adoptable after training and many farmers can use the technology since it reduces losses incurred during and after harvesting.</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• The TIMP increases farm income through reduction of postharvest losses.</li> <li>• There is increased employment for women and youth</li> <li>• There is increased food security and nutrition for households</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• It is labor intensive for some VMGs especially the PLWD and the sick.</li> <li>• VMGs lack access to information on new technologies and information</li> <li>• VMGs have no finances due to limited access to credit facilities</li> <li>• Mechanical harvesting can be encouraged to all gender, including the VMGs.</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Adoption of the TIMP means reduced postharvest losses,</li> <li>• This will enable VMGs to have enough tomato to consume, hence get macro- and micronutrients (especially minerals)</li> <li>• Adherence to recommended harvesting procedures offers opportunities for lucrative commercial venture, hence more income for VMGs</li> </ul>
<b>E: Case studies/profile of Success stories</b>	
Success stories from previous similar projects	Youth groups in Kiambu, farmers in peri-urban Nairobi County have reported improved incomes from adopting the TIMP

Application guidelines for users	Wayua, F., Ndambuki, J., Ochieng, V. and Wasilwa, L. (2020). Tomato Harvesting. KALRO/KCSAP Programme Factsheet No. #
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Kandara, P. O. Box xx Thika Email: <a href="mailto:kalro.kandara@kalro.org">kalro.kandara@kalro.org</a>
Lead organization and scientists	KALRO: Agnes Ndegwa, Gathambiri Charity, Vincent Ochieng, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.9.3 TIMP name</b>	<b>Sorting and grading</b>
Category (i.e. technology, innovation or management practice)	Management practices
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Reduced productivity (inferior quality and low incomes) from unsorted and ungraded tomato
What is it? (TIMP description)	<p>Sorting is done to remove damaged, diseased fruits, insect damage, rotten fruits and debris.</p> <p>Grading is categorization of tomato according to colour (uniformity of ripening) and fruit size. Based on size, there are 3 grades:</p> <p>Grade 1: Big size fruits of uniform colour and shape</p> <p>Grade 2; Medium size fruits of uniform colour and shape</p> <p>Grade 3: Small size fruits, with slight variation in colour and shape.</p>  <p><i>Sorting of tomato</i></p>
Justification	Sorting eliminates tomatoes of poor quality and prevent cross contamination between spoilt and good tomato. Grading help handlers to categorise tomato in a given common parameter which enables easy handling. For instance, grading on the basis of colour or maturity stage will

	help eliminate overripe tomatoes which will easily produce ethylene to hasten the ripening process in the whole batch. Tomato of superior quality fetch higher prices in the market
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, processors, extension service providers
Approaches used in dissemination	Farmer trainings, Field Demonstrations, Farmer Field Schools, shows, trade fairs, promotional materials (posters, brochures, leaflets, manuals)
Critical/essential factors for successful promotion	Application of good agricultural practices to have a good crop Increase of productivity per unit Application of harvesting TIMPs
Partners/stakeholders for scaling up and their roles	County Government- to provide extension services and funding Seed companies- to provide improved certified seeds and varieties; Individual farmers- to grow and sell tomatoes, Farmer groups/CBOs to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers – to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka-Nithi, Meru, Kajiado, Trans Nzoia
Counties where TIMP will be upscaled	Siaya, Elgeyo- Marakwet, Garissa, Mandera, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>Lack of knowledge on sorting and grading of tomato as per market requirements</li> <li>Negative attitude by farmers towards adoption of new agricultural TIMPs</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>Continuous capacity building with practical demonstrations</li> <li>Availing data on economics and the gains to be made through adoption of the TIMP</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>Involvement of stakeholders such as CBOs and NGOs enhances adoption</li> <li>Continuous capacity building is key to attitude change.</li> <li>Consistent trainings, demonstrations and sensitisations would motivate farmers to adopt the TIMP</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>Farmers will be willing to adopt the technology</li> <li>There will be favourable policy for adoption of the technology</li> <li>The market will be able to absorb saved tomato fruits from reducing harvesting losses</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Not done
Estimated returns	Reduced losses, better income and nutrition (due to appropriate sorting and grading techniques)
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>In the target counties, tomato cultivation is mainly done by women increasing their work burden</li> <li>Women loss their crops due to inappropriate sorting and grading as a result of being overworked</li> </ul>

	<ul style="list-style-type: none"> <li>• Women have no finances to pay for hired labor for sorting and grading due to limited access to credits</li> <li>• Women have less access to information, technology and knowledge</li> <li>• Men dominate most decisions at the household and community levels</li> <li>• Women are exploited by middle men and brokers due to limited market information and extension</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• The TIMP increases farm income through reduction of postharvest losses.</li> <li>• There is increased employment for women and youth</li> <li>• There is increased food security and nutrition for households</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• It is labor intensive for some VMGs especially the PLWD and the sick.</li> <li>• VMGs lack access to information on new technologies and information</li> <li>• VMGs have no finances due to limited access to credit facilities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Adoption of the TIMP means reduced postharvest losses,</li> <li>• This will enable VMGs to have enough tomato to consume, hence get macro- and micronutrients (especially minerals)</li> <li>• Adherence to recommended sorting and grading procedures offers opportunities for lucrative commercial venture, hence more income for VMGs</li> </ul>
<b>E: Case studies/profile of Success stories</b>	
Success stories from previous similar projects	Youth groups in Kiambu, farmers in peri-urban Nairobi County have reported improved incomes from adopting the TIMP
Application guidelines for users	Wayua, F., Ndambuki, J., Ochieng, V. and Wasilwa, L. (2020). Tomato Sorting and Grading. KALRO/KCSAP Programme Factsheet No. #
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Kandara, P. O. Box xx Thika Email: <a href="mailto:kalro.kandara@kalro.org">kalro.kandara@kalro.org</a>
Lead organization and scientists	KALRO: Agnes Ndegwa, Gathambiri Charity, Vincent Ochieng, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors


<b>2.9.4 TIMP name</b>	<b>Evaporative charcoal cooler</b>
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Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	High postharvest losses (approximately 30%) caused by lack of cooling technologies for tomato
What is it? (TIMP description)	<p>The Evaporative Charcoal Cooler consist of storage chamber (of suitable capacity), made of galvanized iron frame reinforced with wire mesh inside out, leaving a 10-cm wide cavity which is filled with charcoal. The charcoal is kept moist with water through a drip system. The inside chamber is cooled through evaporation of the water in the charcoal, and can be used for short term storage of tomatoes and other perishable agricultural produce. The charcoal cooler can be customized according to the farmers need and available resources</p>  <p><i>Evaporative charcoal cooler for fruits and vegetables</i></p>
Justification	Appropriate cooling reduces postharvest losses and extends shelf-life, hence the tomatoes can be marketed and consumed over a long period and distances. The charcoal cooler can be used by off-the grid farmers since it does not require any form of power.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, vegetable grocers, processors, household consumers, extension service providers
Approaches used in dissemination	On-farm and on-station demonstrations, agricultural exhibitions, field days agricultural shows, extension officers, mass media – agricultural programs promotional materials (posters/brochures/leaflets, manuals)

Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Use of locally available materials to construct the coolers</li> <li>• Funding to promote the coolers</li> <li>• Formation of marketing groups that would construct the coolers communally</li> <li>• County and Central Government support</li> </ul> <p>Well organized farmer groups and networks</p>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers groups to be trained in postharvest handling of the tomato</li> <li>• Scientists and agricultural extension workers- to provide farmers with knowledge on charcoal cooler</li> <li>• Market players to create a demand and, therefore, increase area under production</li> <li>• County governments, central governments for development of enabling policies and create awareness.</li> <li>• Financial institutions to provide credit facilitation</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka-Nithi, Meru,
Counties where TIMP will be upscaled	Siaya, Elgeyo- Marakwet, Garissa, Mandera, West Pokot
Challenges in dissemination	Lack of knowledge on evaporative charcoal cooler Limited materials to construct the charcoal cooler Lack of starter capital to construct the cooler
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Awareness creation and capacity building about the technology to farmers and traders</li> <li>• Avail appropriate financing</li> </ul>
Lessons learned in upscaling if any	Need to continue capacity building of the farmers and users on repair and maintenance of the coolers
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized marketing channels is critical for benefits to be derived from technology</li> <li>• Existing and new export markets are developed and maintained</li> <li>• The charcoal should be continuously moist. Cooling is more effective in dry and windy environment</li> <li>• Proper linkages between industry, farmer cooperatives, local and regional markets, and bulk purchases</li> <li>• Policies to encourage cold chain in horticulture sector are implemented.</li> <li>• Favourable policy, encouraging better prices for properly-preserved tomato</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
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"> <li>• The technology can be practiced by all gender categories basically gender friendly though some of the activities are more suited to one gender for example carrying, loading and stacking packed tomato crates in charcoal cooler</li> <li>• Cost may be prohibitive for some requirements</li> </ul>

Gender related opportunities	If concerns are addressed, all gender categories can easily use the technology to ensure good tomato quality is maintained and best prices fetched by holding produce to time favourable market
VMG issues and concerns in development, dissemination, adoption and scaling up	Some activities that require physical exercise may not be suitable for VMGs
VMG related opportunities	The technology offers opportunities to VMGs to engage in a lucrative commercial venture since farmers can hold tomato produce for some time while awaiting good market prices without compromising on quality of produce
<b>E: Case studies/profile of Success stories</b>	
Success stories from previous similar projects	Youth groups in Kiambu, farmers in peri-urban Nairobi County have reported increased incomes from adopting the technology
Application guidelines for users	<ul style="list-style-type: none"> <li>Wayua, F. Ndambuki, J., Ochieng, V. and Wasilwa, L. (2021). Zero Energy Cool Chamber. KALRO/KCSAP Programme Factsheet. September 2021</li> <li>Wayua, F., Okoth, M. W. and Wangoh, J. (2012). Design and performance assessment of a low-cost evaporative cooler for storage of camel milk in arid pastoral areas of Kenya. <i>International Journal of Food Engineering</i>, Vol. 8, Issue 1, Article 6.</li> </ul>
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>F: Contacts</b>	
Contacts	KALRO-Kakamega, P. O. Box 169-50100 Kakamega Email: Francis.Obuoro@kalro.org
Lead organization and scientists	KALRO: Francis Wayua, Gathambiri Charity, Vincent Ochieng, James Ndambuki
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.9.5 TIMP name</b>	<b>Zero Energy Cooling Unit</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	High postharvest losses (approximately 30%) caused by lack of cooling technologies for tomato at farm level
What is it? (TIMP description)	The Zero Energy Cooling Unit consist of a double brick wall filled with sand in between, and a storage chamber. The sand is kept moist with water through a drip system. The inside chamber is cooled through evaporation of the water in the sand, and can be used for short term storage of tomatoes and

	<p>other perishable agricultural produce. The cooler can be customized according to the farmers need and available resources</p>  <p><i>Zero energy cooler for fruits and vegetables</i></p>
<p>Justification</p>	<p>Appropriate cooling reduces postharvest losses and extends shelf-life, hence the tomatoes can be marketed and consumed over a long period and distances. The zero energy cooler can be used by off-the grid farmers since it does not require any form of power, and increases the shelf life and quality of tomatoes by keeping them in cool environment. The chamber is easy to build and maintain making it suitable for small-scale farmers. The technology is inexpensive, efficient, and environmentally sustainable.</p>
<p><b>B: Assessment of dissemination and scaling up/out approaches</b></p>	
<p>Users of TIMP</p>	<p>Farmers, traders, vegetable grocers, processors, household consumers, extension service providers</p>
<p>Approaches used in dissemination</p>	<p>On-farm and on-station demonstrations, agricultural exhibitions, field days agricultural shows, extension officers mass media – agricultural programs promotional materials (posters/brochures/leaflets, manuals)</p>
<p>Critical/essential factors for successful promotion</p>	<ul style="list-style-type: none"> <li>• Use of locally available materials to construct the coolers</li> <li>• Funding to promote the coolers</li> <li>• Formation of marketing groups that would construct the coolers communally</li> <li>• County and Central Government support</li> <li>• Well organized farmer groups and networks</li> </ul>
<p>Partners/stakeholders for scaling up and their roles</p>	<ul style="list-style-type: none"> <li>• Farmers groups to be trained in postharvest handling of the tomato</li> <li>• Scientists and agricultural extension workers- to provide farmers with knowledge on zero energy cooler</li> <li>• Market players to create a demand and, therefore, increase area under production</li> <li>• County governments, central governments for development of enabling policies and create awareness.</li> <li>• Financial institutions to provide credit facilitation</li> </ul>


<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Embu, Kirinyaga, Kiambu, Machakos
Counties where TIMP will be upscaled	Siaya, Elgeyo- Marakwet, Garissa, Mandera, West Pokot, Kajiado
Challenges in dissemination	Lack of knowledge on zero energy cooler Limited materials to construct the zero energy cooler Lack of starter capital to construct the cooler
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Awareness creation and capacity building about the technology to farmers and traders</li> <li>• Avail appropriate financing</li> </ul>
Lessons learned in upscaling if any	Need to continue capacity building of the farmers and users on repair and maintenance of the coolers
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized marketing channels is critical for benefits to be derived from technology</li> <li>• Existing and new export markets are developed and maintained</li> <li>• The sand should be continuously moist. Cooling is more effective in dry and windy environment</li> <li>• Proper linkages between industry, farmer cooperatives, local and regional markets, and bulk purchases</li> <li>• Policies to encourage cold chain in horticulture sector are implemented.</li> <li>• Favourable policy, encouraging better prices for properly-preserved tomato</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
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"> <li>• The technology can be practiced by all gender categories; basically gender friendly though some of the activities are more suited to one gender for example carrying, loading and stacking packed tomato crates in cooler</li> <li>• Cost may be prohibitive for some requirements</li> </ul>
Gender related opportunities	If concerns are addressed, all gender categories can easily use the technology to ensure good tomato quality is maintained and best prices fetched by holding produce to time favourable market
VMG issues and concerns in development, dissemination, adoption and scaling up	Some activities that require physical exercise may not be suitable for VMGs VMGs have less access to agricultural information, technology and knowledge VMGs have limited access to productive resources such as capital and credit VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness

VMG related opportunities	The technology offers opportunities to VMGs to engage in a lucrative commercial venture since farmers can hold tomato produce for some time while awaiting good market prices without compromising on quality of produce
<b>E: Case studies/profile of Success stories</b>	
Success stories from previous similar projects	Youth groups in Kiambu, Kajiado and farmers in peri-urban Nairobi County have reported increased incomes from adopting the technology
Application guidelines for users	Wayua, F. Ndambuki, J., Ochieng, V. and Wasilwa, L. (2021). Zero Energy Cool Chamber. KALRO/KCSAP Programme Factsheet. September 2021
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>F: Contacts</b>	
Contacts	KALRO-Kakamega, P. O. Box 169-50100 Kakamega Email: Francis.Obuoro@kalro.org
Lead organization and scientists	KALRO: Francis Wayua, Gathambiri Charity, Vincent Ochieng, James Ndambuki
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.9.6 TIMP name</b>	<b>Modified Atmosphere Packaging (MAP)</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	High postharvest losses that occur due to high perishability of tomato.
What is it? (TIMP description)	Modified atmospheric Packaging (MAP) is the use of barrier packaging material such as polybags that controls exchange of gas in and out of packaging containers. The packaging material allows modification of gas inside creating a suitable atmosphere to improve the shelf life of produce. The modification lowers amount of oxygen and increases inert gases such as carbon dioxide and nitrogen. Low levels of oxygen reduces rate of respiration and infestation by pathogens thus improving the shelf life of tomato.
Justification	Tomato fruits are highly perishable, proper packaging enhances their shelf life. High respiration rate during packaging increases postharvest losses. Modified Atmosphere Packaging reduces respiration rate due to modification of gas inside the package and is a technology that should be promoted.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, extension service providers


Approaches used in dissemination	Farmer trainings, Field Demonstrations, Farmer Field Schools, shows, trade fairs
Critical/essential factors for successful promotion	Good collaboration between all partners Adequate facilitation: Funds, Logistics (Transport)
Partners/stakeholders for scaling up and their roles	County Government- to provide extension services and funding Seed companies- to provide improved certified seeds and varieties; Individual farmers- to grow and sell tomatoes, Farmer groups/CBOs/Youth groups to link farmers with other stakeholders, source for inputs jointly and seek market outlets; Marketers – to provide viable all year round markets at good prices that spur growth of the crop
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMP will be upscaled	Siaya, Elgeyo- Marakwet, Garissa, Mandera, West Pokot
Challenges in dissemination	Limited information on technology
Suggestions for addressing the challenges	-Training of TOTs
Lessons learned in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary for upscaling	-Organized marketing channels is critical for benefits to be derived from technology
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development and dissemination, adoption and scaling up	-The technology can be easily practiced by all gender categories -Cost may be prohibitive for some requirements
Gender related opportunities	All gender categories can easily use the technology to ensure good tomato quality is maintained
VMG issues and concerns in development, dissemination, adoption and scaling up	-Important to consider VMGs issues when promoting the technology -The activity is suitable for VMGs
VMG related opportunities	-Offers opportunities for commercial venture for VMGs
<b>E: Case studies/profile of Success stories</b>	
Success stories from previous similar projects	-None
Application guidelines for users	-Brochures, Training module
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires	Validation

further research	
<b>F: Contacts</b>	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua
Partner organizations	JKUAT,MOA, Traders, Processors

<b>2.9.7 TIMP Name</b>	<b>CoolBot™</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	High postharvest losses due to lack of appropriate cooling technologies for tomatoes
What is it? (TIMP description)  C	<p>This is a refrigerated cold store that improves the shelf life of fruits and vegetables using less cost. The Coolbot™ is a small electrical device that uses an off-the shelf air conditioner to produce cold air, converting a well-insulated room into a cold room at much lesser cost than that needed to buy a refrigeration unit. It keeps a well-insulated room as cold as 4°C, consistently, while at the same time using about half the electricity of a comparably sized standard compressor. The refrigeration can be powered by electrify powered or solar-powered using CoolBot™.</p>  <p><i>CoolBot™ cold storage container with the Coolbot device connected to the air conditioner (Source: Francis Wayua)</i></p>
Justification	CoolBot™ provides inexpensive, effective cooling. Appropriate cooling reduces postharvest losses and extends shelf-life for consumption and marketing. Farmers who can store their produce longer can take advantage of better prices, as market prices can fluctuate dramatically over time. The refrigeration can be powered by electrify powered (with less electricity consumption) or solar-powered using CoolBot™.

<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, aggregators, traders, exporters, processors, household consumers
Approaches used in dissemination	On-farm and on-station demonstrations, agricultural exhibitions, field days agricultural shows, extension officers, mass media – agricultural programs, promotional materials (posters/brochures/leaflets, manuals), exposure tours to packhouses and collection centres.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Use of locally available materials to construct the coolers</li> <li>• Funding to promote the coolers</li> <li>• Formation of marketing groups that would construct the coolers communally</li> <li>• County and Central Government support</li> <li>• Well organized farmer groups and networks, increase postharvest training and direct farmer outreach</li> </ul>
Partners/stakeholders for scaling up and their roles	Farmers groups to be trained in postharvest handling of tomato Scientists and agricultural extension workers- to provide farmers with knowhow on CoolBot™ Technology
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Embu, Makueni
Counties where TIMP will be up-scaled	Machakos, Uasin Gishu, Kericho, Tharaka Nithi
Challenges in dissemination	Lack of knowledge on the technology and the benefits of cooling tomato Limited awareness of the technology by farmers Inadequate funds to install the CoolBot™
Suggestions for addressing the challenges	Awareness creation about the technology to farmers and traders Capacity building of value chain actors on how to use the technology Linkage to credit facility providers to promote commercialization, advocacy for its widespread use
Lessons learned in up scaling if any	Linking entrepreneurs to credit and market enhances adoption of CoolBot™ technology Farmers have often been encouraged to form groups as a strategy to enhance their bargaining power. Groups have also exploited group advantage to get training/extension services and buy agro-inputs more cheaply.
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• The CoolBot™ can be solar powered, hence ideal in areas with good amount of solar radiation</li> <li>• Ability of farmers to practice collective marketing of tomato</li> <li>• Proper linkages between industry, farmer cooperatives, local and regional markets, and bulk purchases</li> <li>• Existing and new export markets are developed and maintained</li> <li>• Policies to encourage cold chain in horticulture sector are implemented.</li> <li>• Favourable policy, encouraging better prices for properly-preserved tomatoes</li> </ul>

<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	CoolBot™™ (US\$ 300)/(Khs 40,0000) Air conditioner Insulated room Monthly electricity costs
Estimated returns	Increased income. Farmers can store tomatoes to sell in the off-season when prices are higher. Improved cold storage facilities will stabilize tomato prices, giving consumers access to nutritious fresh produce all year. Farmers are better protected to erratic market prices.
Gender issues and concerns in development, dissemination, adoption and scaling up	Women may not have access to resources required for adoption of the enterprise. Women may have less access to information, and knowledge
Gender related opportunities	The TIMP increases farm income through reduction of harvest losses by pre-cooling the produce. Women can capitalize on this aspect of tomato production to reduce harvest losses
VMG issues and concerns in development, dissemination, adoption and scaling up	VMGs have less access to agricultural information, technology and knowledge VMGs have limited access to productive resources such as capital and credit VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness
VMG related opportunities	Adoption of the TIMPs means reduced losses, hence more tomato available for consumption and sale. There will be more income for the farmers (VMGs)
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Fruit and vegetable farmers in Embu, Kirinyaga, etc. have reported increased income from adoption of the technology. Karurumo Smallholder Horticulture Aggregation and Processing Centre, in Embu County. Use of the technology has enabled the Centre to sell their fruits to different buyers for between KES 6 and 10 a piece, up from the KES 3 to 5 offered by most buyers during the peak season.
Application guidelines for users	Wayua, F. Ndambuki, J., Ochieng, V. and Wasilwa, L. (2021). CoolBot™. KALRO/KCSAP Programme Factsheet. September 2021
<b>F: Status of TIMP readiness</b> (Ready for up-scaling; Requires validation; Requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Kakamega, P. O. Box 169-50100 Kakamega Email: Francis.Obuoro@kalro.org
Lead organization and scientists	KALRO: Francis Wayua, Gathambiri Charity, Vincent Ochieng, James Ndambuki
Partner organizations	JKUAT, MOA, Traders, Processors, NGOs, CBOs

<b>2.9.8 TIMP Name</b>	<b>Wakati™ technology</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	High postharvest losses due to lack of appropriate cooling technologies for tomatoes
What is it? (TIMP description)	<p>Wakati™ is a simple and innovative solution where altered environment in the chamber contributes to shelf life extension - Altered environment is due to:</p> <p>High relative humidity - Oxidation of ethylene from the storage environment by oxidizing (ozone oxidation) It is a 1m by 1m canvas tent with a solar powered fan at one corner. The fan is placed in cuplike reservoir. As it rotates, it picks up water into mist droplets, which are distributed in the tent by air currents. When a moisture concentration of 80% is achieved, the surface of the fruit or vegetables remain fresh because there is no loss of water. This low-cost solution helps produce last up to 10 times longer without any refrigeration</p>  <p><i>source: Internet</i></p>
Justification	Appropriate cooling reduces postharvest losses. The technology increases the length of time vegetables can be stored without refrigeration, gives farmers more time to sell. The climate control approach used by Wakati™ is affordable and clean technology.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers and sellers of fresh vegetables (green grocers). It is appropriate for rural farmers and agro-dealers.
Approaches used in dissemination	On farm and on station demonstrations, agricultural exhibitions, agricultural shows, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), exposure tours
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Use of locally available materials to construct the coolers</li> <li>• Funding to promote the coolers</li> </ul>
Partners/stakeholders for scaling up and their roles	<p>Farmers groups to be trained in postharvest handling of the vegetables</p> <p>Scientists and agricultural extension workers- to provide farmers with knowhow on Wakati™Technology</p>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Embu, Makueni
Counties where TIMP will be up-scaled	Machakos, Uasin Gishu, Kericho, Tharaka Nithi

Challenges in dissemination	Lack of knowledge on the technology and the benefits of cooling tomatoes Limited awareness of the technology by farmers Inadequate funds to install the Wakati™
Suggestions for addressing the challenges	Awareness creation about the technology to farmers and traders - Capacity building of value chain actors on how to use the technology Linkage to credit facility providers to promote commercialization, advocacy for its widespread use
Lessons learned in up scaling if any	Need to continue capacity building of the farmers and users on construction, repair and maintenance of the technology
Social, environmental, policy and market conditions necessary for development and up scaling	The optimal use of Wakati™ is outside, in a warm and dry climate. Apart from a small amount of water— around 1L of water a week—it does not require any extra resources. The product does not need a power grid, it works on solar energy. To enhance adoption, work with industry, farmer cooperatives, local and regional markets, and bulk purchases to adopt the Wakati™
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	The entire kit costs about KES 10,000/-
Estimated returns	Reduced postharvest losses, increased income, enhanced nutrition
Gender issues and concerns in development ,dissemination, adoption and scaling up	Women may not have access to resources required for adoption of the enterprise. Women may have less access to information, and knowledge
Gender related opportunities	The TIMP increases farm income through reduction of harvest losses by pre-cooling the produce. Women can capitalize on this aspect of tomato production to reduce harvest losses
VMG issues and concerns in development, dissemination, adoption and scaling up	VMGs have less access to agricultural information, technology and knowledge VMGs have limited access to productive resources such as capital and credit VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness
VMG related opportunities	Adoption of the TIMPs means reduced losses, hence more tomato available for consumption and sale. There will be more income for the farmers (VMGs)
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Fruit and vegetable farmers in Embu, Kirinyaga, etc. have adopted the technology
Application guidelines for users	Ndinya, C., Omari, F., Wayua, F., Odendo, M., Muriuki, J., Wandera W., Okoko, N., Ndubi, J., Nyaga, A., Nasirembe, W. and Ndung'u, J. (2021). Inventory of Climate Smart Agriculture African Indigenous Vegetables, Technologies, Innovations and Management Practices. KALRO / KCSAP project, February 2021.
<b>F: Status of TIMP readiness</b> (Ready for up-scaling; Requires	Requires validation

validation; Requires further research)	
<b>G: Contacts</b>	
Contacts	The Centre Director, KALRO-Kitale, P.O. Box 450-30200. Kitale Email: <a href="mailto:director.fcrl@kalro.org">director.fcrl@kalro.org</a> , Phone: +254-020 350 9161
Lead organization and scientists	KALRO, James Ndambuki, Francis Wayua, Violet Kirigua and Lusike Wasilwa
Partner organizations	Agricultural University Colleges, MoAFLC, NGOs, CBOs

<b>2.9.9 TIMP name</b>	<b>Improved packaging for cherry tomatoes</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Cherry tomatoes is a new commodity that requires appropriate packaging for marketing. Proper packaging can enhance product appearance as well as maintain postharvest quality. Proper packaging can also ensure better prices for the farmers
What is it? (TIMP description)	Cherry tomatoes are packaged in plastic containers (punnets). Each package weighs 250g and contains consistent size of tomatoes. A label is affixed to the package and contains key information about the product. The information includes the cultivar, some key nutritional information and shelf life.
Justification	The improved package improves presentation of the product which makes it fetch higher price. This increases revenue to the farmer/grower. The package also protects the tomatoes from advance environmental conditions enabling longer storage. Information provided on the label guides consumers and other supply chain actors to handle and use the product appropriately.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Growers, extension service providers, transporters/traders, consumers
Approaches to be used in dissemination	TV programmes on agriculture, ASK shows, Exhibition and trade fair, Agricultural magazines, demonstrations
Critical/essential factors for successful promotion	-Favourable policy on environmentally friendly packaging materials
Partners/stakeholders for scaling up and their roles	Growers for supply of produce; Extensionservice providers for technology dissemination;Packaging material suppliers for design and supply of appropriate packaging material; Media for promotion

<b>C: Current situation and future scaling up</b>	
Current extent of reach	Limited
Counties where already promoted, if any	Kiambu
Counties where TIMP will be upscaled	Kiambu, Kajiado, Nairobi
Challenges in dissemination	None
Suggestions for addressing the challenges	N/A
Lessons learned in upscaling, if any	None
Social, environmental, policy and market conditions necessary for development and upsaling	The policy on the use of plastic may render the technology inapplicable. New materials may be required.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KSh. 105,000 per 240sq.m (Assuming 7000 punnets @ KSh. 15)
Estimated returns	KSh 1,400,000 per 240sq.m (Assuming 7000 punnets @ KSh. 200)
Gender issues and concerns in development, dissemination, adoption and scaling up	All gender categories can participate in the development and dissemination.
Gender related opportunities	This is a value addition commercial venture that offers opportunities for empowerment of disadvantaged gender categories such as women and youth
VMG issues and concerns in development, dissemination, adoption and scaling up	No issue
VMG related opportunities	This is a value addition commercial enterprise that offers opportunities for empowerment of VMGs
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	The use of punnets packaging is widely common in high end market and offers producers better prices. It ensures hygienic and aesthetic display which has better visual appeal. The produce is protected from the environment to some extent while on the shelf and in household storage before consumption
Application guidelines for users	Guidelines to be formulated and provided
<b>F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research</b>	Requires validation
<b>G: Contacts</b>	
Contacts	Jomo Kenyatta University of Agriculture and Technology (JKUAT), Department of Horticulture and Food Security
Lead organization and scientists	JKUAT, John M. Wesonga
Partner organizations	Wago Company Limited and IMG Co. Ltd, Japan

## Research Gaps



1. The policy on the use of plastic may render the technology inapplicable. Testing of alternative new packaging materials may be required

## 2.10 Value Addition

<b>2.10.1 TIMP name</b>	<b>Processing of tomato into pulp</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	-High Postharvest losses in tomato -Low returns during glut harvest -Lack and /or limited information, expertise and skills in tomato value addition
What is it? (TIMP description)	Fresh tomato is value added by processing into pulp to prolong shelf life. The pulp can be further processed to other value added products such as sauce, paste and ketchup.
Justification	Tomato fruit is highly perishable resulting to postharvest losses and short shelf life. Processing of tomato fruits into various products enhances shelf life thus ensuring availability during off season. Agro-processing adds value to the fruits resulting in increased economic returns to farmers involved in value addition or various value chain actors. Processing tomato into various value added products also diversifies marketing and usage of tomato.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Traders/processors and Extension service providers
Approaches used in dissemination	Value chain actors trainings, Demonstrations, Farmer Field Schools, shows, trade fairs
Critical/essential factors for successful promotion	Good collaboration between all partners Adequate facilitation: Funds, Logistics (Transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs, Youth Groups to grow produce and also engage in cottage level value addition, KBS for regulation of standards of value added products, traders to market value added products
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru
Counties where TIMP will be upscaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	-Limited processing infrastructure available to interested beneficiaries


	-Short shelf life of processed products especially preserves -Lack of quality standards of processed products
Suggestions for addressing the challenges	-Access to credit -Availability of small scale processing equipment -Develop technology on how to extend shelf life of tomato preserves
Lessons learned in up-scaling if any	Demonstrations approach works Effective extension services is essential for adoption of the technologies
Social, environmental, policy and market conditions necessary for upscaling	Organized producers groups to ensure consistence availability of raw materials Organized marketing channels
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	-The technology can be easily utilized by all gender categories (especially women and youth)
Gender related opportunities	-It offers good opportunity for commercial venture that can empower all gender categories
VMG issues and concerns in development, dissemination, adoption and scaling up	-The technology can be easily utilized by all VMGs
VMG related opportunities	-Offers opportunities for lucrative commercial venture by VMGs
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be upscaled to cottage industry level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.10.2 TIMP Name</b>	<b>Dehydrated tomato</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	

Problem addressed	<ul style="list-style-type: none"> <li>-High Postharvest losses in tomato</li> <li>-Low returns during glut harvest</li> <li>-Lack and /or limited information, expertise and skills in tomato value addition</li> </ul>
What is it? (TIMP description)	<p>These are tomato slices that have been dried through removal of water either by solar driers or other types of driers</p>   <p><i>Dehydrated tomato</i></p>
Justification	<p>Tomato fruit is highly perishable resulting to high postharvest losses and short shelf life. Processing of tomato fruits into dried products enhances shelf life thus ensuring availability during off season. Apart from extending shelf-life, dehydration reduces space in packaging, shipping, storage and transportation. The dried tomatoes can be crushed into powder too. The powder can be used to make sauce, juice and soup. Value added products fetch increased economic returns for farmers and other value chain actors.</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, Traders/processors and Extension service providers
Approaches used in dissemination	Value chain actors trainings, Demonstrations, Farmer Field Schools, shows, trade fairs
Critical/essential factors for successful promotion	Good collaboration between all partners Adequate facilitation: Funds, Logistics (Transport)
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs, Youth Groups to grow produce and also engage in cottage level value addition, KBS for

	regulation of standards of value added products, traders to market value added products
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru in other horticultural crops
Counties where TIMP will be upscaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	Limited processing infrastructure available to interested beneficiaries Short shelf life of processed products especially preserves Lack of quality standards of processed products
Suggestions for addressing the challenges	-Access to credit -Availability of small scale processing equipment -Develop technology on how to extend tomato preserves
Lessons learned in upscaling if any	Demonstrations approach works Effective extension services is essential for adoption of the technologies
Social, environmental, policy and market conditions necessary for upscaling	Organized producers groups to ensure consistence availability of raw materials Organized marketing channels
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Ingredients: 3kg of tomatoes valued at KSh 30/- per kg (farm gate price) = KSh 90/-
Estimated returns	3kg of tomatoes produce 1 kg of dried product, valued at KSh 400/-. Hence estimated returns are KSh 400-90 = KSh 310/- gross profit.
Gender issues and concerns in development, dissemination, adoption and scaling up	-The technology can be easily utilized by all gender categories (especially women and youth)
Gender related opportunities	-It offers good opportunity for commercial venture that can empower all gender categories
VMG issues and concerns in development, dissemination, adoption and scaling up	-The technology can be easily utilized by all VMGs
VMG related opportunities	-Offers opportunities for lucrative commercial venture by VMGs
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Embu in other horticultural produce. Tomato farmers in Kibwezi, Makueni County have reported increased income from solar drying of tomatoes.
Application guidelines for users	Wayua, F. Ndambuki, J., Ochieng V. and Wasilwa, L. (2020). Dried Tomato. KALRO/KCSAP Programme, Tomato Value addition Factsheet No. #




<b>Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.10.3 TIMP name</b>	<b>Tomato Jam</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	-High Postharvest losses in tomato -Low returns during glut harvest -Lack and /or limited information, expertise and skills in tomato value addition
What is it? (TIMP description)	Tomato jam is a fruit preserve prepared from tomato pulp and sugar  <i>Tomato jam</i>
Justification	Tomato fruit is highly perishable resulting to postharvest losses and short shelf life. Processing of tomato fruits into various products enhances shelf life thus ensuring availability during off season. Agro-processing adds value to the fruits resulting in increased economic returns to farmers involved in value addition or various value chain actors. Processing tomato into various value added products also diversifies marketing and usage of tomato.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, small-scale processors, industrial and commercial processors, extension service, providers
Approaches used in dissemination	Value chain actors trainings, demonstrations, Farmer Field Schools, shows, trade fairs
Critical/essential factors for successful promotion	Good collaboration between all partners Stakeholder capacity building and networks Promotion involving Public Private Partnerships (ppp)

	Farmers should organize themselves into growers' associations which facilitate setting up of factories to process tomato into various products; The government should facilitate affordable credit to empower farmers take up tomato agribusiness.
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs, Youth Groups to grow produce and also engage in cottage level value addition, KBS for regulation of standards of value added products, traders to market value added products
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru
Counties where TIMP will be upscaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Limited awareness of product by farmers and consumers</li> <li>• Limited processing infrastructure available to interested beneficiaries</li> <li>• Short shelf life of processed products especially preserves</li> <li>• Lack of credit facilities</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Awareness creation about the the product to farmers, consumers and other value chain actors</li> <li>• Capacity of value chain actors on how to prepare the product</li> <li>• Linkage to credit facility providers to promote commercialisation</li> </ul>
Lessons learned in up-scaling if any	Demonstrations approach works Effective extension services is essential for adoption of the technologies
Social, environmental, policy and market conditions necessary for upscaling	Organized producers groups to ensure consistence availability of raw materials Organized marketing channels
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<i>Ingredients:</i> Ripe tomatoes 1 kg = KSh 30/- (farm gate price) Sugar 1 kg = KSh 150/- Lemons 3 pieces = KSh 30/- These produce 0.5kg of jam Total costs = 210/-
Estimated returns	0.25kg of jam costs KSh 400/- (market price), Hence 1 kg tomatoes produce 0.5kg of jam, valued at KSh 800/-. This gives a gross profit of KSh 800-210 = KSh 590/- per kg of fresh tomato
Gender issues and concerns in development, dissemination, adoption and scaling up	-The technology can be easily utilized by all gender categories (especially women and youth) <ul style="list-style-type: none"> <li>• Women have limited mobility to sell tomato products due to limited mobility and exposure</li> </ul>

	<ul style="list-style-type: none"> <li>Processing is mainly done by women, who have limited access and control of resources such as finances</li> </ul>
Gender related opportunities	It offers good opportunity for commercial venture that can empower all gender categories
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>VMGs lacks access to information on new technologies and information</li> <li>VMGs have limited access to productive resources such as credit facilities and value addition equipment</li> </ul>
VMG related opportunities	-Offers opportunities for lucrative commercial venture by VMGs in processing and selling tomato jam
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	Farmers and traders in Nyeri, Kirinyaga and Kisumu have reported increased incomes from adopting the TIMP.
Application guidelines for users	<ul style="list-style-type: none"> <li>Ndambuki, J., Wayua, F., Ochieng, V. and Wasilwa, L. (2020). Tomato jam. KALRO/KCSAP Programme Factsheet No. #</li> <li>KIRDI (2007). <i>Processing Tomatoes</i>. CTA Practical Guide Series, No. 12.</li> </ul>
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua, James Ndambuki
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.10.4 TIMP name</b>	<b>Tomato juice</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>-High Postharvest losses in tomato</li> <li>-Low returns during glut harvest</li> <li>-Lack and /or limited information, expertise and skills in tomato value addition</li> </ul>
What is it? (TIMP description)	This is ready to drink juice prepared from tomato

		
<i>Tomato juice</i>		
Justification	<p>Tomato fruit is highly perishable resulting to postharvest losses and short shelf life. Processing of tomato fruits into various products enhances shelf life thus ensuring availability during off season. Agro-processing adds value to the fruits resulting in increased economic returns to farmers involved in value addition or various value chain actors. Processing tomato into various value added products also diversifies marketing and usage of tomato.</p>	
<b>B: Assessment of dissemination and scaling up/out approaches</b>		
Users of TIMP	Farmers, traders, small-scale processors, industrial and commercial processors, extension service, providers	
Approaches used in dissemination	Value chain actors trainings, demonstrations, Farmer Field Schools, shows, trade fairs	
Critical/essential factors for successful promotion	<p>Good collaboration between all partners  Stakeholder capacity building and networks  Promotion involving Public Private Partnerships (PPP)  Farmers should organize themselves into growers' associations which facilitate setting up of factories to process tomato into various products; The government should facilitate affordable credit to empower farmers take up tomato agribusiness.</p>	
Partners/stakeholders for scaling up and their roles	<p>Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs, Youth Groups to grow produce and also engage in cottage level value addition, KBS for regulation of standards of value added products, traders to market value added products</p>	
<b>C: Current situation and future scaling up</b>		
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru	
Counties where TIMP will be upscaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot	
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Limited awareness of product by farmers and consumers</li> <li>• Limited processing infrastructure available to interested beneficiaries</li> <li>• Short shelf life of processed products especially preserves</li> </ul>	

	<ul style="list-style-type: none"> <li>• Lack of credit facilities</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Awareness creation about the product to farmers, consumers and other value chain actors</li> <li>• Capacity of value chain actors on how to prepare the product</li> <li>• Linkage to credit facility providers to promote commercialisation</li> </ul>
Lessons learned in up-scaling if any	<p>Demonstrations approach works</p> <p>Effective extension services is essential for adoption of the technologies</p>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Farmers willing to adopt the TIMP</li> <li>• Organized producer groups to ensure consistence availability of raw materials for processing</li> <li>• Environment suitable for production of tomato and processing into juice</li> <li>• County governments adopt and implement policies for tomato value addition, including juice processing</li> <li>• Existing and new markets are developed and maintained (available buyers)</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<p><i>Ingredients:</i></p> <p>Ripe tomatoes 1 kg = KSh 30/- (farm gate price)</p> <p>Sugar 2 table spoon (to taste) = negligible</p> <p>Lemons 1 pieces = KSh 10/-</p> <p>These produce 0.83L of juice</p> <p>Total costs = 40/-</p>
Estimated returns	<p>1L of tomato juice costs KSh 229/- (market price), Hence 0.83L of tomatoes will cost KSh 190/-. This gives a gross profit of KSh 190.10-40 = KSh 150/- per kg of fresh tomato</p>
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The technology can be easily utilized by all gender categories (especially women and youth)</li> <li>• Women have limited mobility to sell tomato products due to limited mobility and exposure</li> <li>• Processing is mainly done by women, who have limited access and control of resources such as finances</li> </ul>
Gender related opportunities	<p>Opportunity for women and youth in processing and selling of tomato juice, hence income earning opportunity</p>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs lacks access to information on new technologies and information</li> <li>• VMGs have limited access to productive resources such as credit facilities and value addition equipment</li> </ul>
VMG related opportunities	<p>-Offers opportunities for lucrative commercial venture by VMGs in processing and selling tomato juice</p>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	<ul style="list-style-type: none"> <li>• Farmers and traders in Nyeri, Kirinyaga and Kisumu have reported increased incomes from processing and selling tomato juice.</li> <li>• Del Monte factory in Thika is processing and selling tomato juice at KSh 229 per litre and reporting good business</li> </ul>


Application guidelines for users	<ul style="list-style-type: none"> <li>• Ndambuki, J., Wayua, F., Ochieng, V. and Wasilwa, L. (2020). Ready to Drink Tomato Juice. KALRO/KCSAP Programme Factsheet No. #</li> <li>• KIRDI (2007). <i>Processing Tomatoes</i>. CTA Practical Guide Series, No. 12.</li> </ul>
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua, James Ndambuki
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.10.5 TIMP name</b>	<b>Tomato sauce and ketchup</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>-High Postharvest losses in tomato</li> <li>-Low returns during glut harvest</li> <li>-Lack and /or limited information, expertise and skills in tomato value addition</li> </ul>
What is it? (TIMP description)	<p>Tomato sauce is a sauce made from tomatoes and spices, and is usually served as part of a dish. Tomato ketchup is similar to tomato sauce except that it is thick in consistency, slightly sweeter and, therefore, more acceptable.</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p><i>Tomato juice</i></p>
Justification	Tomato fruit is highly perishable resulting to postharvest losses and short shelf life. Processing of

	tomato fruits into various products enhances shelf life thus ensuring availability during off season. Agro-processing adds value to the fruits resulting in increased economic returns to farmers involved in value addition or various value chain actors. Processing tomato into various value added products also diversifies marketing and usage of tomato.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, small-scale processors, industrial and commercial processors, extension service, providers
Approaches used in dissemination	Value chain actors trainings, demonstrations, Farmer Field Schools, shows, trade fairs
Critical/essential factors for successful promotion	Good collaboration between all partners Stakeholder capacity building and networks Promotion involving Public Private Partnerships (PPP) Farmers should organize themselves into growers' associations which facilitate setting up of factories to process tomato into various products; The government should facilitate affordable credit to empower farmers take up tomato agribusiness.
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs, Youth Groups to grow produce and also engage in cottage level value addition, KBS for regulation of standards of value added products, traders to market value added products
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru
Counties where TIMP will be upscaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Limited awareness of product by farmers and consumers</li> <li>• Limited processing infrastructure available to interested beneficiaries</li> <li>• Short shelf life of processed products especially preserves</li> <li>• Lack of credit facilities</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Awareness creation about the product to farmers, consumers and other value chain actors</li> <li>• Capacity of value chain actors on how to prepare the product</li> <li>• Linkage to credit facility providers to promote commercialisation</li> </ul>
Lessons learned in up-scaling if any	Demonstrations approach works Effective extension services is essential for adoption of the technologies
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Farmers willing to adopt the TIMP</li> <li>• Organized producers groups to ensure consistence availability of raw materials for processing</li> </ul>

	<ul style="list-style-type: none"> <li>• Environment suitable for production of tomato and processing into sauce and ketchup</li> <li>• County governments adopt and implement policies for tomato value addition, including juice processing</li> <li>• Existing and new markets are developed and maintained (available buyers)</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<i>Ingredients:</i> 3 kg of raw tomato (valued at KSh 30/- per kg farm gate price) produce 1kg of ketchup, valued at KSh 175/-
Estimated returns	Gross profit of KSH 175-120/- per kg of tomato
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The technology can be easily utilized by all gender categories (especially women and youth)</li> <li>• Women have limited mobility to sell tomato products due to limited mobility and exposure</li> <li>• Processing is mainly done by women, who have limited access and control of resources such as finances</li> </ul>
Gender related opportunities	Opportunity for women and youth in processing and selling of tomato sauce and ketchup, hence income earning opportunity
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs lacks access to information on new technologies and information</li> <li>• VMGs have limited access to productive resources such as credit facilities and value addition equipment</li> </ul>
VMG related opportunities	-Offers opportunities for lucrative commercial venture by VMGs in processing and selling tomato sauce and ketchup
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	<ul style="list-style-type: none"> <li>• Farmers and traders in Nyeri, Kirinyaga and Kisumu have reported increased incomes from processing and selling tomato juice.</li> <li>• Del Monte factory in Thika is processing and selling tomato juice at KSh 229 per litre and reporting good business</li> </ul>
Application guidelines for users	<ul style="list-style-type: none"> <li>• Ndambuki, J., Wayua, F., Ochieng, V. and Wasilwa, L. (2020). Tomato Sauce and Ketchup. KALRO/KCSAP Programme Factsheet No. #</li> <li>• KIRDI (2007). <i>Processing Tomatoes</i>. CTA Practical Guide Series, No. 12.</li> </ul>
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua, James Ndambuki
Partner organizations	JKUAT, MOA, Traders, Processors


## 2.11 Mechanization of Tomato Production Activities

2.11.1 TIMP name	Power tiller
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>• Slow and tedious processes of Manual land preparation</li> <li>• Drudgery and fatigue</li> <li>• Low output</li> <li>• Inefficiency and inconsistency of work.</li> <li>• Untimeliness</li> </ul>
What is it? (TIMP description)	<p>A Power Tiller is a two-wheeled agricultural machine fitted with either rotary tillers, disk harrow, mouldboard plough, trailer, chisel or water pump at alternate times for easing farm operations. It can complete 0.5ha per hour by one operator. This will vary depending on the climatic conditions, soil types, soil moisture content, stamina and experience of the operator. Fuel consumption is about 15 litres per ha.</p> 
Justification	<p>It has multiple uses and among other advantages. A Power Tiller helps in preparing the soil, sowing seeds, planting seeds, spraying the fertilizers, herbicides and water. In addition to it also helps in pumping water, harvesting, threshing and transporting crops. A power Tiller is ideal where the land size is small. Farm sizes average less than one hectares which limit turning ability of conventional tractors while manual labour is costly and slow.</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>

Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs, Youth Groups to grow produce and also engage in cottage level value addition, KEBS for regulation of standards of value added products, traders to market value added products
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the machines</li> <li>• Fear of machines</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>
Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	Organized producers' groups to ensure consistence availability of raw materials Organized marketing channels
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Power tiller – KES 280,000 Plough – Free on purchasing a power tiller Harrow – Free on purchasing a power tiller
Estimated returns	2ha per day using two different operators
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Tomato tilling equipment should be designed for easy start and operation by all gender</li> <li>• Power tiller would make work easier for women but women have limited finances to pay for services or to purchase farm equipment due to limited access to credit facilities</li> <li>• Women have limited access and control of other productive resources such as land , information and farm equipment</li> <li>• Up-scaling should target all the gender and it should be affordable to all gender</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• It offers good opportunity for commercial venture that can empower especially the youth</li> <li>• Power tiller increases participation of household members in tilling maize farms that is women, men and youth</li> <li>• Creates employment especially for youth</li> <li>• Reduces drudgery for women farmers as well as men</li> </ul>


VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Operating power tiller is complex for some VMGs especially those who are abled differently</li> <li>• VMGs have less access to agricultural information, technology and knowledge so they might have information of the equipment</li> <li>• VMGs have limited finances to pay for services or to purchase farm equipment due to limited access to credit facilities</li> <li>• VMGs need to be equipped with information relating to the power tiller</li> <li>• Power tillers need to be designed in such a way as to would enable people abled differently to operate it</li> <li>• Power tiller need to be affordable and easy to maintain by all kinds of farmers</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Offers opportunities for lucrative commercial venture by VMGs</li> <li>• Reduces drudgery for VMGs. Time saved can be used in other productive agricultural activities</li> <li>• Increases food production and nutrition for VMGs</li> <li>• The technology can be easily utilized by all VMGs</li> </ul>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.11.2 TIMP name</b>	<b>Wheeled tractor less than 50Hp</b>
Category (i.e. technology, innovation ,or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>• Slow and tedious processes of seedbed preparation, in the commercialized tomato commodity</li> <li>• Drudgery and fatigue</li> </ul>

	<ul style="list-style-type: none"> <li>• Low output</li> <li>• Inefficiency and inconsistency of work.</li> <li>• Untimeliness</li> <li>• High cost of manual labour</li> </ul>
What is it? (TIMP description)	<p>A tractor is an engineering vehicle specifically designed to deliver a high tractive effort (or torque) at slow speeds, for the purposes of hauling a trailer or machinery such as that used in agriculture. Most commonly, the term is used to describe a farm vehicle that provides the power and traction to mechanize agricultural tasks, especially (and originally) tillage, trailer towing, planting, weeding, ridging, planting, spraying, harvesting, ground grading and much more agricultural functions. Agricultural implements may be towed behind, mounted behind or in front of the tractor and the tractor may also provide a source of power if the implement is mechanized. It is therefore fitted with various equipment at alternate times for easing farm operations</p> 
Justification	A Tractors is an essential necessity of farming as it provides machine power for performing farm applications. In addition to routine farm activities, it is efficient, timely, consistent, releases labour and reduces cost as compared to manual labour. With a small horse power of 50, it is affordable.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> </ul>

	<ul style="list-style-type: none"> <li>• Lack of the tractors</li> <li>• Fear of machines</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying a tractor</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>
Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<p>Organized producers' groups to ensure consistence availability of raw materials</p> <p>Organized marketing channels</p>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<p>Tractor – KES 1,500,000</p> <p>Plough – KES 350,000</p> <p>Harrow – KES 400,000</p>
Estimated returns	2ha per day
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The wheeled tractor 50Hp is gender unfriendly hence it cannot be operated by women</li> <li>• Women and youth have limited finances to pay services or purchase farm equipment due to limited access to credit facilities such as 4 wheeled tractor 50Hp</li> <li>• Men dominate most decisions at the household and community levels hence they make decisions relating to land preparation for tomato farms</li> <li>• Tomato farming machines should be designed for easy start and operation for all gender</li> <li>• Up-scaling should target all the gender</li> <li>• There is need to equip women, youth and other stakeholders with information relating to the TIMP</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Creates employment especially for youth</li> <li>• Reduces drudgery for women farmers as well as men</li> <li>• Promotes inclusivity of all genders</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Operating 4 wheeled tractor 50Hp is complex for some VMGs especially those who are abled differently</li> <li>• VMGs have less access to agricultural information, technology and knowledge hence they might not know about 4 wheeled tractor 50Hp</li> <li>• VMGs have limited finances to pay services and to purchase farm equipment due to limited access to credit facilities</li> <li>• VMGs need to be equipped with information relating to the TIMP</li> <li>• Linking the VMG to financial institutions would enable them to purchase the tractor since it is affordable and easy to maintain</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Offers opportunities for lucrative commercial venture by VMGs</li> <li>• Can create employment for VMG at local level</li> <li>• Reduces drudgery for VMG farmers</li> </ul>


<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Traders, Processors

<b>2.11.3 TIMP name</b>	<b>Mold board plough</b>
Category (i.e. Technology, Innovation or Management Practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>• Unbroken heavy clods in the soil and gives it an uneven structure.</li> <li>• Uneven plough depth</li> <li>• Requirement of added weight for ballasting.</li> </ul>
What is it? (TIMP description)	<p>Mouldboard plough is an agricultural implement and is generally considered to be an 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. The plough conserves moisture and biomass while pulverizing the soil hence climate smart.</p>  <p>Source; captain tractors pvt. Ltd</p>

Justification	Has High Efficiency and when well-adjusted, the plough automatically seeks the desired depth. It is Versatile. The various models have different features that enable high efficiency in preparation of the land. Enables weed Control, Pest Control and Improved Soil Health.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the mould board ploughs</li> <li>• Fear of machines</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying the plough</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>
Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized producer groups to ensure consistence availability of raw materials</li> <li>• Organized marketing channels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Plough – KES 380,000
Estimated returns	5 year working
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited finances to pay services and to purchase farm equipment due to limited access to credit facilities</li> <li>• Men dominate most decisions at the household and community levels hence determines the type of facilities to be used in their farms</li> <li>• Meld board plough is especially unfriendly to women and also expensive to purchase</li> <li>• Maize farming machines should be designed for easy start and operation by all gender.</li> </ul>


	<ul style="list-style-type: none"> <li>Meld board plough would make work easier for women but women will not be able to purchase the equipment due to lack of finances as a result of limited access to credit facilities</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>It offers good opportunity for commercial venture that can empower all gender categories</li> <li>Creates employment especially for youth</li> <li>Reduces drudgery for women farmers as well as men</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>Operating <b>Meld board plough</b> plough is complex for some VMGs especially those who are abled differently</li> <li>VMGs have less access to agricultural information, technology and knowledge</li> <li>VMGs have limited finances to pay services and to purchase farm equipment due to limited access to credit facilities</li> <li>Linking the VMG to financial institutions would enable them to buy since the plough since it is affordable and easy to maintain</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>Offers opportunities for lucrative commercial venture by VMGs</li> <li>Can create employment for VMG at local level</li> <li>Reduces drudgery for VMG farmers</li> </ul>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katamani@kalro.org">cd.katamani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Tractor hire service contractors

<b>2.11.4 TIMP name</b>	<b>Disc harrow</b>
Category (i.e. Technology, Innovation or Management Practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>Slow and tedious processes of seedbed preparation, in a commercialized tomato commodity</li> <li>Difficult to break clods manually</li> </ul>

	<ul style="list-style-type: none"> <li>• Delayed operation lead to late planting</li> <li>• Low acreage because of lack of manual labour</li> <li>• High cost of manual labour</li> </ul>
What is it? (TIMP description)	<p>A harrow, farm implement used to pulverize soil, break up crop residues, uproot weeds and cover seed. It is a farm implement used for surface tillage. It is used after ploughing for breaking up and smoothing out the surface of the soil. The purpose of harrowing is to break up clods and to provide a smooth soil structure, called tilth, that is suitable for planting seeds. Coarser harrowing may also be used to remove weeds and to cover seed after sowing.</p>  <p>Source; <a href="https://fonts.gstatic.com/s/i/productlogos/lens_camera/v1/192px.sv">https://fonts.gstatic.com/s/i/productlogos/lens_camera/v1/192px.sv</a></p>
Justification	Has High Efficiency and when well-adjusted, the plough automatically seeks the desired depth. It is versatile. The various models have different features that enable high efficiency in preparation of the land. Enables weed Control, Pest Control and Improved Soil Health.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the mould board ploughs</li> <li>• Fear of machines</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying the harrow</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>


Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized producer groups to ensure consistence availability of raw materials</li> <li>• Organized marketing channels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Harrow – KES 350,000
Estimated returns	3 year working
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women may not be aware of the technology due to their limited access to education, training and extension</li> <li>• Disk Harrow is gender unfriendly especially for women to operate</li> <li>• Disk harrow should be designed for easy start and operation.</li> <li>• The machine is expensive for tomato stakeholders to purchase especially women</li> <li>• Women and youth have limited finances to pay for services and to purchase farm equipment due to limited access to credit facilities</li> <li>• Men dominate most decisions at the household and community levels hence determines the type of equipment to be used in farms</li> <li>• Up-scaling should target all the gender</li> <li>• There is need to equip women, youth and stakeholders with information relating to the TIMP</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Creates employment especially for youth.</li> <li>• Reduces drudgery for women farmers as well as men</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Operating a disk harrow is complex for some VMGs especially those who are abled differently</li> <li>• VMGs have less access to agricultural information, technology and knowledge hence they might not be aware of the existence of a disk harrow and how it is operated</li> <li>• VMGs have limited finances to pay services and to purchase farm equipment due to limited access to credit facilities</li> <li>• VMGs need to be equipped with information relating to the TIMP</li> <li>• Farm machines need to be designed in such a way which would enable people able differently to operate</li> <li>• In addition they need to be affordable and easy to maintain machines for all types of farmers</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Can create employment for VMG at local level</li> <li>• Reduces drudgery for VMG farmers</li> </ul>

<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Tractor hire service contractors

<b>2.11.5 TIMP name</b>	<b>Multi-function seedbed ridging machine</b>
Category (i.e. Technology, Innovation or Management Practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>• Poor drainage</li> <li>• Insufficient root depth for growth</li> <li>• Poor root aeration</li> <li>• Poor moisture infiltration</li> </ul>
What is it? (TIMP description)	<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, provides 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>  <p>(Source:<a href="https://www.google.com/url">https://www.google.com/url</a>)</p>

	?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)
Justification	Machine seedbed ridging is uniform in tilth and height. It saves time in ridge formation of seedbeds, cheaper and enhances labour productivity.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the mould Multi-function seedbed ridging machine</li> <li>• Fear of machines</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying the Multi-function seedbed ridging machine</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>
Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized producer groups to ensure consistence availability of raw materials</li> <li>• Organized marketing channels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Raised Seedbed maker – KES 750,000
Estimated returns	10 year working
Gender issues and concerns	<ul style="list-style-type: none"> <li>• High initial cost for purchasing the machine especially</li> </ul>

in development, dissemination, adoption and scaling up	<p>for tomato women farmers who have limited access to credit</p> <ul style="list-style-type: none"> <li>• Limited access to decision making on land use for women</li> <li>• Multi-function seedbed ridging machine should be easy to use for all gender</li> <li>• Up-scaling should target all the gender</li> <li>• There is need to equip women, youth and stakeholders with information relating to the seedbed ridging machine</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• It offers good opportunity for commercial venture that can empower all gender categories</li> <li>• Creates employment especially for youth</li> <li>• Reduces drudgery for women farmers as well as men</li> <li>• Power tiller increases participation of household members in tilling tomato farms that is women, men and youth</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The technology can be easily utilized by all VMGs</li> <li>• VMGs have less access to agricultural information, technology and knowledge so they might have information of the equipment</li> <li>• VMGs have limited finances to pay services and to purchase farm equipment due to limited access to credit facilities</li> <li>• VMGs need to be equipped with information relating to the TIMP</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Offers opportunities for lucrative commercial venture by VMGs</li> <li>• Can create employment for VMG at local level</li> <li>• Reduces drudgery for VMGs</li> </ul>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katamani@kalro.org">cd.katamani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Tractor hire service contractors

<b>2.11.6 TIMP name</b>	<b>Tomato direct planter</b>
Category (i.e. Technology, Innovation or Management Practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>• Poor moisture infiltration Slow and tedious processes of seed placement</li> <li>• High cost of manual labour</li> <li>• Roots can fail to spread out over a wide area and fail for roots access to plenty of oxygen.</li> <li>• Large root systems are vulnerable to extremes of wet and dry periods</li> </ul>
What is it? (TIMP description)	<p>A tomato planter is a device used in agriculture that opens furrows, meters, sow's tomato seed by positioning them in the soil and burying them to a specific depth without forming a ridge along seed rows. The Tomato planter sows seed at the proper seeding rate and depth, ensuring that the seeds are covered by soil. This management practice skips the nursery preplanning procedure</p> 
Justification	<ul style="list-style-type: none"> <li>• Manual planting increase the amount of seed used and may require thinning</li> <li>• Fertilizer use is not evenly distributed when manually applied</li> <li>• Tomato seed is small making planting depth critical and difficult to attain when manually done and seed shallowly planted will germinate with poor yields</li> <li>• Row planting increases yields, easy to manage weeds and pests, and more importantly timely uniform and low labour requirement,</li> </ul>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>

Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kirinyaga, Tharaka Nithi, Meru
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the tomato direct planter</li> <li>• Lack of knowledge in calibration</li> <li>• Fear of machines</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying the tomato direct planter Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>
Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized producer groups to ensure consistence availability of raw materials</li> <li>• Organized marketing channels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Direct planter – KES 550,000
Estimated returns	15 year working
<b>Gender issues and concerns in development, dissemination, adoption and scaling up</b>	<ul style="list-style-type: none"> <li>• Tomato direct Planter may not be easy for women to operate</li> <li>• Women and youth have limited access to productive resources such as land, credit, and other inputs</li> <li>• Women and youth have limited access to education, training and extension services than men hence might not be aware of tomato direct planter</li> <li>• Women and youth have limited access to production resources such as land, capital to purchase the planter</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Linking the women and youth to financial institutions would enable them access finances to hire or purchase to buy tomato direct planter</li> <li>• Creates employment especially for youth</li> <li>• Reduces drudgery for women tomato farmers</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have less access to agricultural information, technology and knowledge</li> <li>• VMGs have limited finances to pay services and to purchase farm equipment due to limited access to credit facilities</li> <li>• Operating the planter may be complex especially for those VMGs who are abled differently</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Linking the VMG to financial institutions would enable them to buy Tomato direct Planter since it is affordable and easy to maintain</li> <li>• Offers opportunities for lucrative commercial venture by VMGs</li> <li>• Can create employment for VMG at local level</li> </ul>


	<ul style="list-style-type: none"> <li>Reduces drudgery for VMGs</li> </ul>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Requires validation
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Tractor hire service contractors

<b>2.11.7 TIMP name</b>	<b>Seedling tray planter</b>
Category (i.e. Technology, Innovation or Management Practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>Poor moisture infiltration Slow and tedious processes of seed placement</li> <li>High cost of manual labour</li> <li>Roots can fail to spread out over a wide area and fail for roots access to plenty of oxygen.</li> <li>Large root systems are vulnerable to extremes of wet and dry periods</li> </ul>
What is it? (TIMP description)	<p>A 220V Fully Automatic Cave Plate Educate seedling machine Vegetable seed planter. The soil loading and conveying device has a frequency conversion speed regulation system, which is fully matched with the speed of the next process.</p> <p>It has an automatic photoelectric sensor detection system, no soil, no seeding. Using a button one-key operating system, paving, pressing holes, and planting are integrated to complete a simple, practical and fast seed recovery device, so that the seeds are not wasted.</p> <p>It is suitable for seeds between 0.3-12mm, the shape of the seeds is not limited, and the scope of application is wide. Can choose to add soil spreader, sprinkler.</p>

	 <p>(Source: <a href="https://s.alicdn.com/@sc04/kf/Hb4c358ebe1574892a7302c3e5c4f459cA.jpg_960x960.jpg">https://s.alicdn.com/@sc04/kf/Hb4c358ebe1574892a7302c3e5c4f459cA.jpg_960x960.jpg</a>)</p>
Justification	<ul style="list-style-type: none"> <li>• Seedling trays facilitate the use of a wider range of herbicides</li> <li>• Are more efficient while growing hybrid seeds which can be expensive compared to traditional ones.</li> <li>• Done properly, seedling trays cushion your seeds against fungal diseases common in the conventional method.</li> </ul>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Muguga
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the tomato tray planter</li> <li>• Lack of knowledge in calibration</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying the tomato tray planter</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>

Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized producer groups to ensure consistence availability of raw materials</li> <li>• Organized marketing channels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Seedling tray planter – KES 1,040,280
Estimated returns	200trays/hour one tray has 50seedlings
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women and youth have limited access to productive resources such as land, credit, and other inputs so they might not be able to adopt the TIMP</li> <li>• Women, who have limited access to education, training and extension services might not be aware of the TIMP</li> <li>• Women might not be aware of the benefits of planting tomato using the seedling tray planter and they might only look at the cost for hiring or purchasing the planter</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Employment opportunities for youth as service providers</li> <li>• offers good opportunity for business that can empower all gender categories</li> <li>• There would be increased production of tomatoes hence improved food security and nutrition</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited access to productive resources such as land and credit.</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> <li>• Due to prejudice associated with their social status, VMGs are excluded from access to and benefits from improved technologies. Thus, affirmative action is required to promote tomato farming among the VMGs</li> <li>• VMG groups could have limitations in accessing the knowledge and resources to enable them use the seedling tray planter</li> <li>• VMG have less access to extension training as they are not given equal opportunities so they might not be aware of the TIMP</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Business opportunities for VMGs</li> <li>• There would be employment opportunities for VMGs as service providers</li> <li>• There is potential of increased productivity leading to food security and nutrition for VMGs households</li> <li>• There is potential of increased incomes for VMGs</li> </ul>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on


	tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Requires validation
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Tractor hire service contractors

<b>2.11.8 TIMP name</b>	<b>Tomato trans planter</b>
Category (i.e. Technology, Innovation or Management Practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>• Poor moisture infiltration Slow and tedious processes of seed placement</li> <li>• High cost of manual labour</li> <li>• Roots can fail to spread out over a wide area and fail for roots access to plenty of oxygen.</li> <li>• Large root systems are vulnerable to extremes of wet and dry periods</li> </ul>
What is it? (TIMP description)	<p>A tomato seedling trans planter is a mechanical trans planter that can transplant plants in conical and cylindrical sod up to 7 cm of diameter. It can work on plastic film, paper film and bare ground, both in greenhouses and an open field.</p> <p>This machine can be combined with the Ferrari film layer FP, with the aim of carrying out the two operations at the same time and with one machine only.</p> <p>The first step consists on laying the plastic film down (polyethylene, biodegradable and paper) and on covering it by ploughshares that are adjustable in height and in depth. At the same time, the FPA machine transplants plants through the film</p>  <p>(Source:</p>

	<a href="https://www.google.com/url?sa=i&amp;url=https%3A%2F%2Fbrandsequipment.com%2Fferrari.php&amp;psig=AOvVaw2aigYdP2Ktqiyw_GkXk49&amp;ust=1666271796494000&amp;source=images&amp;cd=vfe&amp;ved=0CA0QjRxqFwoTCJDdqKaw7PoCFQAAAAAdAAAAABA Y)">https://www.google.com/url?sa=i&amp;url=https%3A%2F%2Fbrandsequipment.com%2Fferrari.php&amp;psig=AOvVaw2aigYdP2Ktqiyw_GkXk49&amp;ust=1666271796494000&amp;source=images&amp;cd=vfe&amp;ved=0CA0QjRxqFwoTCJDdqKaw7PoCFQAAAAAdAAAAABA Y)</a>
Justification	<ul style="list-style-type: none"> <li>• Fertilizer use is not evenly distributed when manually applied</li> <li>• Tomato seedling is small making planting depth critical and difficult to attain when manually done and seedling shallowly planted will fail to pick</li> <li>• Raw planting increases yields, easy to manage weeds and pests, and more importantly timely uniform and low labour requirement,</li> </ul>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Muguga
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the tomato tray planter</li> <li>• Lack of knowledge of calibration</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying the tomato tray planter</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>
Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized producer groups to ensure consistence availability of raw materials</li> <li>• Organized marketing channels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Trans-Planter – KES 840,280
Estimated returns	500 seedlings /hour

Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Men dominate most decisions at the household and community levels hence determines the type of facilities to be used in their farms</li> <li>• Women and youth have limited finances to pay services and to purchase farm equipment due to limited access to credit facilities</li> <li>• Women have limited access to credit therefore may not have the finances to purchase the expensive Tomato Trans planter</li> <li>• Tomato Trans planter should be designed for easy start and operation by women</li> <li>• Up-scaling of Tomato Trans planter should target all the gender</li> <li>• There is need to equip women, youth and stakeholders with information relating to Tomato Trans planter</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• There is need to link women and youth to financial institutions to enable them the buy Tomato Trans planter</li> <li>• Creates employment especially for youth as service providers</li> <li>• Reduces drudgery especially for women maize farmers</li> <li>• There is potential of increased productivity leading to households food security and nutrition</li> <li>• Increased productivity will also lead to increased incomes for women and youth</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited finances to pay for services or to purchase farm equipment due to limited access to credit facilities</li> <li>• Linking the VMG to financial institutions would enable them to buy since it is affordable and easy to maintain</li> <li>• VMGs have less access to agricultural information, technology and knowledge</li> <li>• Operating Tomato Trans planter may be complex for some VMGs especially those who are abled differently</li> </ul>
<ul style="list-style-type: none"> <li>• VMG related opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Reduces drudgery for VMGs</li> <li>• Would create business opportunities for VMGs</li> <li>• There would be employment opportunities for VMGs at local level as service providers</li> <li>• There is potential of increased productivity leading to food security and nutrition for VMGs households</li> <li>• There is potential of increased incomes for VMGs</li> </ul>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented

<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katamani@kalro.org">cd.katamani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Tractor hire service contractors

<b>2.11.9 TIMP name</b>	<b>Motorized sprayer</b>																																																																								
Category (i.e. Technology, Innovation or Management Practice)	Technology																																																																								
<b>A: Description of the technology, innovation or management practice</b>																																																																									
Problem addressed	<ul style="list-style-type: none"> <li>• Slow and tedious processes of manual spraying of tomato</li> <li>• Inefficient spraying</li> <li>• Drudgery of pumping</li> </ul>																																																																								
What is it? (TIMP description)	<p>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.</p> <div style="display: flex; align-items: center;">  <table border="1" style="font-size: small;"> <caption>Nozzle Guide for Band and Directed Spraying</caption> <thead> <tr> <th></th> <th>Even Flat Fan</th> <th>Narrow Flat Fan</th> <th>Medium Cone</th> <th>Full Cone</th> <th>Disc and Core Cone</th> </tr> </thead> <tbody> <tr> <td><b>Herbicides</b></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>Very Good</td> <td>Good</td> <td></td> </tr> <tr> <td>Post-emergence Contact</td> <td>Good</td> <td>Very Good</td> <td>Very Good</td> <td>Good</td> <td></td> </tr> <tr> <td>Post-emergence Systemic</td> <td>Very Good</td> <td>Good</td> <td>Very Good</td> <td>Good</td> <td></td> </tr> <tr> <td><b>Fungicides</b></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Contact</td> <td>Good</td> <td></td> <td>Good</td> <td></td> <td>Very Good</td> </tr> <tr> <td>Systemic</td> <td>Very Good</td> <td></td> <td></td> <td></td> <td>Good</td> </tr> <tr> <td><b>Insecticides</b></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>Very Good</td> <td>Very Good</td> <td>Very Good</td> <td></td> <td>Very Good</td> </tr> <tr> <td><b>Growth Regulators</b></td> <td>Good</td> <td></td> <td></td> <td>Very Good</td> <td></td> </tr> </tbody> </table> </div> <p>Source; (Nasirembe, Katumani, 2021)</p>		Even Flat Fan	Narrow Flat Fan	Medium Cone	Full Cone	Disc and Core Cone	<b>Herbicides</b>						Pre-emergence	Very Good	Good	Very Good	Good		Post-emergence Contact	Good	Very Good	Very Good	Good		Post-emergence Systemic	Very Good	Good	Very Good	Good		<b>Fungicides</b>						Contact	Good		Good		Very Good	Systemic	Very Good				Good	<b>Insecticides</b>						Contact	Very Good	Very Good	Very Good		Very Good	Systemic	Very Good	Very Good	Very Good		Very Good	<b>Growth Regulators</b>	Good			Very Good	
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Justification	Pest reduce yields up to 98% and are a major menace in agricultural production. Before tomato forms a canopy, broad leafed weeds compete with Cabbage seedling for nutrients and light greatly reducing their yield. A manual sprayer is labour																																																																								

	intensive and spraying labour is too expensive. It has lower presser reducing its efficiency
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Muguga
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the tomato tray planter</li> <li>• Lack of knowledge of calibration</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying the motorized sprayer</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>
Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized producer groups to ensure consistence availability of raw materials</li> <li>• Organized marketing channels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Motorized sprayer – KES 56,000
Estimated returns	0.5ha /hour
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Motorized sprayer is designed for easy start and operation hence it is gender friendly and can be used by women as well</li> <li>• Women and youth have limited finances to pay services and to purchase a motorized sprayer for use in the tomato farms due to limited access to credit facilities</li> <li>• Women have limited access to education, training and extension services than men relating to so they might not be aware of the of motorized sprayer</li> <li>• Men dominate most decisions at the household and community levels hence determines the type of farm equipment and machines to be used in tomato farms</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women stand to benefit from increased production due to nutritional benefits from tomato and increased sale</li> </ul>


	<ul style="list-style-type: none"> <li>• Creates employment especially for youth as service providers</li> <li>• Reduces drudgery for women farmers as well as men</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited finances to purchase motorized sprayer due to lack of access to credit facilities</li> <li>• VMGs have less access to information, technology and knowledge hence they might not be aware of a motorized sprayer</li> <li>• VMGs have limited finances to pay services and to purchase motorized sprayer due to limited access to credit facilities</li> <li>• Operating a motorized sprayer is complex for some VMGs especially those who are abled differently might be a challenge</li> <li>• Motorized sprayer need to be designed in such a way that would enable people abled differently to operate</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Creates employment especially for VMGs</li> <li>• Reduces drudgery for VMGs tomato farmers</li> <li>• Increased production will lead to increased consumption of nutritious food hence improved health for VMGs</li> <li>• Increased income accrued from the sales of tomato will lead to economic empowerment of VMGs</li> </ul>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Tractor hire service contractors

<b>2.11.10 TIMP name</b>	<b>Harvester</b>
Category (i.e. Technology, Innovation or Management Practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>• Labor scarcity is an issue.</li> <li>• Soiling due to human contact</li> </ul>

	<ul style="list-style-type: none"> <li>• Harvesting duration is too long</li> <li>• It is labour intensive</li> <li>• It reduces dependency on the human labour.</li> <li>• Delayed harvesting subjects the crop to getting damaged by natural disasters.</li> </ul>
What is it? (TIMP description)	<p>A tomato combine harvester, is a versatile machine designed to efficiently harvest a variety of grain crops. The name derives from its combining four separate harvesting operations; reaping, gathering detaching, and separating to a single process. In waiting RE trailers on which tomato fruits are off loaded through a spout from the combine harvester</p>  <p>(Source:<a href="https://civileats.com/wp-content/uploads/2015/07/STAR-NTD-Tomato-Harvester-e1436906748749.jpg">https://civileats.com/wp-content/uploads/2015/07/STAR-NTD-Tomato-Harvester-e1436906748749.jpg</a>)</p>
Justification	<p>Among the crops harvested with a combine are mainly grains but according to the Global Alliance for Improved Nutrition (GAIN) tomato is the most consumed vegetable in the world, sometimes harvesting seems a big challenge due to the shortage of labor and increase on wages consequently in the country. However, with the increasing mechanization in the agriculture industry many people are also migrating to the other industrial sectors for their livelihood. This is also a reason that due to the limited number of people, some labor-intensive farming activities like harvesting becomes a big challenge</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato large scale farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field, Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Muguga

Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the tomato tray planter</li> <li>• Lack of knowledge of calibration</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying the motorized sprayer</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>
Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized producer groups to ensure consistence availability of raw materials</li> <li>• Organized marketing channels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Motorized sprayer – KES 13,000,000
Estimated returns	4ha /hour
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women have limited access and control of productive resources such as land, information, farm and equipment</li> <li>• Tomato harvester would make work easier for women but women will not be able to purchase the equipment due to lack of finances resulting from limited access to credit facilities</li> <li>• Tomato harvester is not gender friendly especially for women</li> <li>• Tomato harvesting equipment should be designed for easy start and operation by all gender.</li> <li>• Up-scaling should target all the gender and it should be affordable to all</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Business and employment especially for youth</li> <li>• Reduces drudgery for women farmers as well as men</li> <li>• Tomato harvester increases participation of household members in harvesting tomato farms that is women, men and youth</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Operating maize harvester is complex for some VMGs especially those who are abled differently</li> <li>• VMGs have less access to agricultural information, technology and knowledge so they might have information of the tomato harvester</li> <li>• VMGs have limited finances to pay for services and to purchase farm equipment due to limited access to credit facilities</li> <li>• VMGs need to be equipped with information relating to the tomato harvester</li> </ul>

	<ul style="list-style-type: none"> <li>• Maize harvester need to be designed in such a way as to enable people abled differently operate it</li> <li>• In addition they need to be affordable and easy to maintain by all farmers</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Business and employment opportunity for VMGs</li> <li>• Reduces drudgery for VMGs</li> <li>• Increases food production and nutrition for VMGs</li> </ul>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katamani@kalro.org">cd.katamani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Tractor hire service contractors

<b>2.11.11 TIMP name</b>	<b>Grading</b>
Category (i.e. Technology, Innovation or Management Practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Sorting and grading for colour, shape, mass and Slow and size
What is it? (TIMP description)	<p>This tomato sorting machine is used in tomato processing line to sort and grade the round shape fruits and vegetables by size. Tomato can be feed to the machine automatically, which greatly saves the labour cost and time. It can sort quickly, efficiency and the sorting size can be customized as customers' requirements.</p>  <p>(Source: <a href="https://fruitprocess-media.irematch.com/images/1622708867905tomato-">https://fruitprocess-media.irematch.com/images/1622708867905tomato-</a></p>

	<a href="http://sizer.jpg?x-oss-process=image/autorient,1/watermark,image_aW1hZ2VzL3dhdGVyLWxvZ28ucG5nP3gtb3NzLXByb2Nlc3M9aW1hZ2UvcmlvcmVzaXplLFBfMjA,x_10,y_10">sizer.jpg?x-oss-process=image/autorient,1/watermark,image_aW1hZ2VzL3dhdGVyLWxvZ28ucG5nP3gtb3NzLXByb2Nlc3M9aW1hZ2UvcmlvcmVzaXplLFBfMjA,x_10,y_10)</a>
Justification	Machine sorting is faster, cheaper, releases labour, efficient and tidy
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Tomato farmers, Extension staff, researchers, Universities
Approaches used in dissemination	Value chain actors' trainings, demonstrations, Farmer Field Schools, ASK Shows, trade fairs, Pamphlets, publications etc.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good collaboration between all partners</li> <li>• Adequate facilitation: Funds, Logistics (Transport)</li> <li>• Timeliness, efficiency, cheap cost, multiple usage</li> </ul>
Partners/stakeholders for scaling up and their roles	Ministry of Agriculture-Extension Service for technology dissemination, individual Farmers, farmer groups/CBOs,
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Muguga
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• High initial cost for small-scale farmers</li> <li>• Lack of the tomato tray planter</li> <li>• Lack of knowledge of calibration</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Produce profitably to generate money for buying the motorized sprayer</li> <li>• Acquaintance with machines through training</li> <li>• Encourage group investment</li> </ul>
Lessons learned in up-scaling if any	<ul style="list-style-type: none"> <li>• Low level of extension</li> <li>• Increase farmer machine interaction</li> <li>• Conduct demonstrations</li> </ul>
Social, environmental, policy and market conditions necessary for upscaling	<ul style="list-style-type: none"> <li>• Organized producer groups to ensure consistence availability of raw materials</li> <li>• Organized marketing channels</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Motorized sprayer – KES 56,000
Estimated returns	0.5ha /hour

Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• tomato sorting and grading machine is easy to use and can therefore be operated by all tomato farmers including women</li> <li>• Women and youth have limited finances to pay for tomato sorting and grading services and to purchase the grader for use in the tomato farms due to limited access to credit facilities</li> <li>• Women have limited access to education, training and extension services so they might not be aware of the of tomato grader</li> <li>• Men dominate most decisions at the household and community levels hence determines the type of farm equipment and machines to be used on the tomato farms</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Creates employment especially for youth</li> <li>• Reduces drudgery for women farmers as well as men</li> <li>• It promotes gender inclusivity reducing the work load for women</li> <li>• There is potential of increased productivity leading to households food security and nutrition</li> <li>• Increased productivity will also lead to increased incomes for women and youth</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited finances to pay services and to purchase tomato grading machine due to limited access to credit facilities</li> <li>• VMGs have limited access to other productive resources such as land and equipment hence they might not be able to adopt</li> <li>• VMGs have limited access to training and extension services hence they might not get information on the TIMP</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Can create employment for VMG at local level</li> <li>• Reduces drudgery for VMGs</li> <li>• Increased production will lead to increased consumption of nutritious food hence improved health for VMGs</li> </ul>
<b>E: Case studies/profile of success stories</b>	
Success stories from previous similar projects	This has been done in Kirinyaga at household level but needs to be up scaled contractual level
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato value addition documented
<b>F: Status of TIMP readiness</b> 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling

<b>G: Contacts</b>	
Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos Email: <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0711369535
Lead organization and scientists	KALRO, Egerton University Nasirembe W, Sam Nyakach-0733812953
Partner organizations	JKUAT, MOA, Tractor hire service contractors

## 2.12 Business and Marketing

<b>2.12.1 TIMP Name</b>	<b>Transformative graduation Model of production of Tomato</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to farmers' limited transformation from subsistence-oriented production to commercial-oriented production. Farmers remain at low productivity if there is lack of efforts to shift to commercial level
What is it? (TIMP description)	The transformative model builds resiliency of farmers of Tomato to focus on market orientation. The transformation model aims at a shift from subsistence to semi-commercial to fully commercial. At the subsistence level, farmers use traditional inputs and the outputs consumed at home. At the semi-commercial level, farmers use both traditional and improved inputs while the output is consumed at home and some get into the markets. At fully commercial, inputs are accessed from the markets and outputs solely for the markets.
Justification	Transformative model ensures increase in productivity due to the surplus demand. Without transformation of Tomato production, the crop will remain subsistence and commercialization will not be attainable, leading to the decline in production and income.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, processing industries, Extension, NGOs, Research institutions
Approaches to be used in dissemination	<ul style="list-style-type: none"> <li>• Farmers' meetings</li> <li>• Radio</li> <li>• Television</li> <li>• Social media (WhatsApp, Facebook, twitter) and internet)</li> <li>• Farmers' groups</li> <li>• Agricultural Innovation platforms</li> <li>• Farmer Field and Business Schools</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A platform for interaction of Tomato value chain stakeholders,</li> <li>• Produce acceptance of improved technologies</li> </ul>

	<ul style="list-style-type: none"> <li>• Acceptance of smallholder farmers to produce Tomato</li> <li>• Availability of Tomato enterprise investors, buyers, prices of Tomato</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – investments in Tomato production,</li> <li>• County extension staff - Organization of farmers and technical service delivery,</li> <li>• NGOs – Organization of farmers and service delivery, private sector (local traders and exporters) – Support in input services and providing markets for the Tomato production,</li> <li>• Research institutions – Availing improved seeds, backstopping, producer and marketing organizations – Includes lobby groups</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	The promotion of the transformation is in Kirinyaga County and has been widely adopted across other major tomato growing areas such as Kajiado County
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination	<ul style="list-style-type: none"> <li>• Lack of Tomato innovation platforms to facilitate interaction of farmers with relevant stakeholders,</li> <li>• Disorganization and scattered farmers</li> <li>• Lack of cohesiveness</li> <li>• Small-scale farming</li> <li>• Lack of training in group dynamics</li> <li>• Limited investment by buyers</li> <li>• Fluctuating prices of Tomato</li> <li>• Level of policy support</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Establish Tomato innovation platforms,</li> <li>• Disorganization and scattered farmers – Formation of marketing groups,</li> <li>• Small-scale farming – Aggregation of production, group dynamics – Capacity building,</li> <li>• Limited investment by buyers – County and national government support,</li> <li>• Fluctuating prices of Tomato– Setting minimum price and mobbing up glut from the market,</li> <li>• Policy support – price policy, subsidies, inputs support</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform</li> <li>• Production should be linked with Tomato buyers</li> <li>• Market surveys</li> <li>• Individual marketing instead of collective marketing</li> <li>• Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms</li> </ul>

Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – acceptability by the farmers, group dynamics</li> <li>• Cultures, environmental conditions – Enhancing natural resource management</li> <li>• Policy conditions – Policy support in extension, inputs, prices, production organizations (cooperatives), infrastructure, investment environment</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Tomatoes stakeholders might not been aware of the tomato transformative graduation model due to limited access to agricultural information and extension services</li> <li>• Tomatoes stakeholders especially women have not been able to engage in full commercialization of tomatoes due to limited access to productive resources such as land, farm equipment and credit facilities</li> <li>• Women have been involved in small scale production of tomatoes due to limited funds to purchase required inputs such as seeds, fertilizers, insecticides due to limited access to credit facilities</li> <li>• Women are usually left out when marketing groups and innovation platforms are being formed due to their social economic status in the society so might not be able to get appropriate information relating to existing tomatoes models</li> <li>• In some cultures, women may not be able to travel away from their homes to producer group meetings, without permission hence they are not able to participate in dissemination workshops</li> </ul>
Gender opportunities	<ul style="list-style-type: none"> <li>• There is potential of improved access to market within and without for tomatoes by women and youth</li> <li>• There will be creation of employment for women and youth at every node of tomatoes value chain</li> <li>• If tomato transformative model is adopted there will be increased production and commercialization of tomatoes by women and the youth improving their livelihoods</li> </ul>
VMG issues and concerns in development, dissemination and opportunities	<ul style="list-style-type: none"> <li>• Tomatoes stakeholders might not been aware of the tomato transformative graduation model especially the VMGs due to limited access to agricultural information and extension services</li> <li>• Tomatoes stakeholders especially the VMGs have not been able to engage in full commercialization of tomatoes due to limited access to productive resources such as land, farm equipment and credit facilities</li> <li>• VMGs have been involved in small scale production of tomatoes due to limited funds to purchase required inputs</li> </ul>

	<p>such as seeds, fertilizers, insecticides due to limited access to credit facilities</p> <ul style="list-style-type: none"> <li>• Due to their social status of the VMGs in the society they are often excluded from joining marketing groups and in participating in rural producer organizations limiting them from acquiring marketing information</li> </ul>
VMGs opportunities	<ul style="list-style-type: none"> <li>• VMGs will have access to local and distance markets</li> <li>• There will be creation of employment for VMGs at every node of tomatoes value chain</li> <li>• Increased market information and channels for VMGs</li> <li>• If tomato transformative model is adopted there will be increased production and commercialization of tomatoes by VMGs improving their livelihoods</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	
	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua J.M.,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

### Research Gaps

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

<b>2.12.2 TIMP Name</b>	<b>Building a business plan for tomato production</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to unplanned and traditional production, leading to lack of production targets, losses and market failure
What is it? (TIMP description)	A Tomato business plan serves as an internal management and organizing tool, used to communicate outside the business, or both. The document contains the elements of marketing

	strategy, marketing costs, income streams and financial requirements
Justification	With a business plan in hand, Tomato farmers and rural entrepreneurs will be able to take that first step toward the creation of a successful and sustainable business. The plan enables farmers to control costs, develop marketing strategies and build plans for the production to meet market demand
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders and processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> <li>• Farmer field and business Schools (FFBS)</li> <li>• Agricultural Innovation Platforms (AIP)#</li> <li>• Trainings</li> <li>• Factsheets</li> <li>• Manuals</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A platform for interaction of Tomato value chain stakeholders</li> <li>• Education levels of the farmers and investors in Tomato production</li> <li>• Availability of information on Tomato production and marketing</li> <li>• Seed availability and accessibility</li> <li>• Efficient seed system to ensure quality</li> <li>• Diversification of Tomato food products through value addition</li> <li>• Well organized farmer groups and networks</li> <li>• Established marketing models and path ways</li> <li>• County and central government support</li> <li>• Funding to research</li> <li>• New Tomato varieties</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – Users of business plans, county extension staff - capacity building</li> <li>• NGOs – Capacity building, private sector (local traders, exporters)</li> <li>• Buyers of Tomato</li> <li>• Research institutions – Capacity building, financial Institutions</li> <li>• Financial support</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• Lack of Tomato innovation platforms to facilitate interaction of farmers with relevant stakeholders</li> <li>• Disorganization and scattered farmers</li> <li>• Small-scale farming</li> <li>• Inadequate information to stakeholders on Tomato production and marketing</li> </ul>

	<ul style="list-style-type: none"> <li>• Levels of policy support</li> <li>• Levels of education</li> <li>• Lack of Tomato innovation platforms to facilitate interaction of farmers with relevant stakeholders</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Establish Tomato innovation platforms</li> <li>• Disorganization and scattered farmers – Formation of production clusters</li> <li>• Small-scale farming – aggregation of production to assume large scale-farming</li> <li>• Inadequate information to stakeholders on the Tomato production – Developing information hub</li> <li>• Level of policy support – support in extension services</li> <li>• Levels of education – Capacity building</li> <li>• Establish innovation platforms</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform</li> <li>• Low adoption of business planning</li> <li>• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform</li> <li>• Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms</li> </ul>
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – Acceptable in Counties growing Tomato</li> <li>• Environmental conditions – Availability of water resources</li> <li>• Policy conditions – Policy support in opportunities selected</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women are usually left out when tomatoes marketing groups and innovation platforms are being formed due to their social economic status in the society</li> <li>• Most of the stakeholders involved in tomatoes especially women do not know how to develop a business plan due to low levels of education</li> <li>• Women do not have time to attend organized meetings due to their busy schedules</li> <li>• Women and youth have limited finances to pay for services required to attend agricultural organized dissemination meetings</li> <li>• Women might not be aware of the existing tomatoes marketing groups</li> </ul>

	<ul style="list-style-type: none"> <li>• Women and youth have limited finances to pay for services such as training unlike men due to limited access to credit facilities</li> <li>• In some cultures, women may not be able to travel away from their homes to producer group meetings, without permission</li> <li>• Strict rules of entry and requirements of producers' organizations may limit women from participation</li> </ul>
Gender opportunities	<ul style="list-style-type: none"> <li>• Increased employment opportunities for women in marketing of tomatoes products</li> <li>• There will be increased production of tomatoes by women and youth leading to improve food security and nutrition</li> <li>• Stakeholders in tomatoes will get proper information on marketing leading to improved incomes for tomatoes stakeholders especially women</li> </ul>
VMG issues and concerns in development, dissemination and opportunities	<ul style="list-style-type: none"> <li>• VMGs have less access to marketing information</li> <li>• VMGs do not have time to attend organized meetings due to their busy schedules</li> <li>• VMGs have limited finances to pay services such as training due to their limited access to credit facilities</li> <li>• Some of the VMGs have low levels of education hence they might not be able to develop business plans</li> <li>• VMGs are usually left out when tomatoes marketing groups and innovation platforms are being formed due to their social economic status in the society</li> <li>• VMGs might not be aware of the existing tomatoes marketing groups</li> </ul>
VMGs Opportunities	<ul style="list-style-type: none"> <li>• Increased employment opportunities for VMGS in marketing of tomatoes products</li> <li>• VMGs will get proper information on marketing of tomatoes</li> <li>• There will be increased food security and nutrition for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for Users	<ul style="list-style-type: none"> <li>• Training factsheets</li> <li>• Manuals and power point slides are available</li> </ul>
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	
	Requires validation
<b>G: Contacts</b>	
Contacts	Centre Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

## Research Gaps

- Impact of business plan on Tomato production
- Adoption of business plan

<b>2.12.3 TIMP Name</b>	<b>Collective marketing</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low productivity leading to low production due to small-scale production and marketing of Tomato products. Also market inaccessibility due to individual farmer marketing, leading to low market power
What is it? (TIMP description)	Collective marketing is marketing as a group where farmers establish an entity to create market links. It involves formation of a group of farmers with an objective of reducing market inaccessibility. Collective marketing is carried through Producer Organizations' (POs) is an institutional vehicle for promoting agricultural production by helping farmers solve common problems in relation to production inputs, credit, technical knowledge and marketing of the produce
Justification	Due to small-scale farming of Tomato, 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. The smallholder farmers of Tomato do marketing individually. Due to that, there is lack of economic scale and the prices offered are low. The formation of producer organizations assists small-scale farmers in aggregating the Tomato produce to form a large scale and gain bargaining power for higher prices.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, policy makers, researchers
Approaches to be used in dissemination	<ul style="list-style-type: none"> <li>• Farmer field and business Schools (FFBS)</li> <li>• Agricultural Innovation Platforms (AIP)</li> <li>• Trainings</li> <li>• Factsheets</li> <li>• Manuals</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A platform for interaction of Tomato value chain stakeholders</li> <li>• Production programme outlined</li> <li>• Sell their produce before the collective sale</li> <li>• The farmer is not able to deliver the agreed amount to the group</li> <li>• Side-selling</li> <li>• Bad weather</li> </ul>

	<ul style="list-style-type: none"> <li>• Variable quality</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – Defining production programme</li> <li>• County extension staff - capacity building</li> <li>• NGOs – Capacity building</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• Lack of Tomato innovation platforms to facilitate interaction of farmers with relevant stakeholders</li> <li>• Disorganization and scattered farmers</li> <li>• Small-scale farming</li> <li>• Inadequate information to stakeholders on Tomato production and marketing</li> <li>• Defining production programmes of Tomato</li> <li>• Levels of policy support</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Establish Tomato innovation platforms</li> <li>• Disorganization and scattered farmers – Formation of production clusters</li> <li>• Small-scale farming – aggregation of production to assume large scale-farming</li> <li>• Inadequate information to stakeholders on Tomato production – Developing information hub</li> <li>• Defining production programmes of Tomato – SWOT analysis</li> <li>• Level of policy support – support in extension services</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform</li> <li>• Volume target: low volume due to side-sales</li> <li>• Partnership is important in technology dissemination and adoption and this can be enhanced through innovation platforms</li> </ul>
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – lack of trust among members</li> <li>• Environmental conditions – favourable condition for Tomato production</li> <li>• Policy conditions – Infrastructural support</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety

<p>Gender issues and concerns in development, dissemination and related opportunities</p>	<ul style="list-style-type: none"> <li>• Tomatoes stakeholders might not been aware of the existing marketing groups due to limited access to agricultural information and extension services</li> <li>• Tomatoes stakeholders especially women have not been able to engage in full commercialization of tomatoes due to limited access to productive resources such as land, farm equipment and credit facilities</li> <li>• Women have been involved in small scale production of tomatoes due to limited funds purchase required inputs such as seeds, fertilizers, insecticides due to limited access to credit facilities.</li> <li>• Women are usually left out when tomato marketing groups and innovation platforms are being formed due to their social economic status in the society so might not be able to get appropriate information relating to existing tomatoes marketing models</li> <li>• Women and youth have limited finances to pay services such as training unlike men due to limited access to credit facilities</li> <li>• Women are usually left out when tomatoes marketing groups and innovation platforms are being formed due to their social economic status in the society hence might not be aware of the existing</li> <li>• Strict rules of entry and requirements of producers' organizations may limit women participation</li> </ul>
<p>Gender opportunities</p>	<ul style="list-style-type: none"> <li>• Improved access to market within and without for tomatoes by women.</li> <li>• Increased market information and channels for women and youth hence increased job opportunities</li> <li>• There will be increased sale of tomatoes by women hence increased income.</li> <li>• Involvement of women in the formation of marketing organizations</li> </ul>
<p>VMG issues and concerns in development, dissemination and opportunities</p>	<ul style="list-style-type: none"> <li>• Due to their social status VMGs are often excluded from joining tomatoes marketing groups</li> <li>• VMGs might not be aware of existing tomatoes marketing groups and innovation platforms as they have limited access to agricultural information and extension services</li> <li>• VMGs are excluded when important decision making are being made relating to tomatoes production and marketing</li> <li>• VMGs also have limited participation and influence in rural producer organizations due to limited access to assets, resources and services, required for members to join</li> </ul>
<p>VMG opportunities</p>	<ul style="list-style-type: none"> <li>• Involvement of VMGs in the formation of marketing organization</li> <li>• Improved access to market within and without by VMGs</li> <li>• Increased access to market information and channels by VMGs</li> </ul>

	<ul style="list-style-type: none"> <li>• There will increased incomes for VMGs from the sale of tomatoes</li> <li>• There is potential of increased food security and nutrition by VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for Users	<ul style="list-style-type: none"> <li>• Training factsheets</li> <li>• Manuals and power point slides are available</li> </ul>
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

### Research Gaps

- Profitable opportunities
- Performance of marketing as a group

<b>2.12.4 TIMP Name</b>	<b>Profitability analysis</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to low farmers' income. The problem of failure of profitability analysis is common among the smallholder farmers. Lack of profitability analysis by farmers in Tomato production, leads to lack of comparison of costs and returns and therefore poor performance of the agro-enterprise.
What is it? (TIMP description)	Profitability analysis involves recording of costs and returns and therefore determination of profit which indicates the performance of the Tomato agro-enterprise
Justification	Profitability analysis reviews the management success and sustainability of the Tomato business. It indicates areas of adjustment
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	<ul style="list-style-type: none"> <li>• Farmers</li> <li>• Extension</li> <li>• NGOs</li> </ul>

	<ul style="list-style-type: none"> <li>• Researchers.</li> </ul>
Approaches to be used in dissemination	<ul style="list-style-type: none"> <li>• Farmer field and business Schools (FFBS)</li> <li>• Agricultural Innovation Platforms (AIP)</li> <li>• Trainings</li> <li>• Factsheets</li> <li>• Manuals</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A platform for interaction of Tomato value chain stakeholders</li> <li>• Record keeping of costs and returns</li> <li>• Ability of farmers to keep records</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – record keeping, county extension staff – Facilitators</li> <li>• NGOs – Facilitators</li> <li>• Private sector (local traders and exporters) – Buyers</li> <li>• Research institutions – Facilitators</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	- The variety was promoted in Kirinyaga County and has been widely adopted across other major tomato growing areas such as Kajiado County
Counties where TIMPs will be upscaled	- Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• Lack of Tomato innovation platforms to facilitate interaction of farmers with relevant stakeholders</li> <li>• Inability of farmers to keep records</li> <li>• Use of non-costed family labour in Tomato production</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Establish Tomato innovation platforms</li> <li>• Inability of farmers to keep records – capacity building</li> <li>• Use of non-costed family labour in Tomato production – capacity building on how to cost family labour</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform</li> <li>• Availability of market</li> <li>• Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms</li> </ul>
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – Awareness on record keeping</li> <li>• Environmental conditions – suitable for the increased production of Tomato, policy conditions – Policy support in costs of inputs and prices of outputs, market conditions – Higher prices than costs</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700

Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> <li>• Women engaging in tomatoes production have not been to make profits from the sale of their produce due to limited knowledge in profit analysis.</li> <li>• Women are associated with poor performance within the tomatoes value chain has been attributed to their lack of concern relating to costs and returns</li> <li>• Most women farmers especially those involved in tomatoes production are semi-illiterate hence they are not able keep records on tomatoes production costs and their sales</li> <li>• Women and youth have limited access to agricultural information and extension services especially relating to marketing of agricultural products as tomatoes</li> <li>• Women do not have time to attend organized meetings due to their busy schedules</li> <li>• Women and youth have limited finances to pay services such as training unlike men due to limited access to credit facilities</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women and youth will be able to keep records of the profit they make from tomatoes</li> <li>• There will be increased markets local and distance increasing incomes for women and youth</li> <li>• There will be increase employment for women and youth at various nodes of tomatoes value chain</li> </ul>
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited information on marketing hence being exploited by middle men</li> <li>• The VMGs do not have access to external markets</li> <li>• The VMGs have limited finances which limits them from paying for services such as trainings</li> <li>• VMGs have limited access to agricultural information and extension especially relating to marketing of tomatoes</li> <li>• VMG farmers especially those involved in tomatoes production are semi-illiterate hence they would not be able to keep records on the costs incurred in tomatoes production and profits made after the sale</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• VMGs will be able to keep records of the profit they make from tomatoes</li> <li>• There will be increased markets local and distance increasing incomes for VMGs</li> <li>• There will be increase employment for VMGs at various nodes of tomatoes value chain</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Ready for upscaling

<b>G: Contacts</b>	
Contacts	Centre Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

## Research Gaps

- Investigation on strategies to reduce costs of production of Tomato
- Investigation on price increasing strategies

<b>2.12.5 TIMP Name</b>	<b>Market research for market information</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to lack of market information. Failure of the smallholder farmers in gathering information on markets, leads to knowledge asymmetries among the smallholder farmers. Also this leads to poor connectivity of smallholders to distance markets.
What is it? (TIMP description)	Market research gathers information on the product buyers, demand, type required, minimum volume purchased, collective marketing volume, quality, packaging requirements, frequency of delivery, purchase price, means of payment and willing to buy from local farmers
Justification	Without market research, the smallholder farmers will continue being market disintegrated and lack of information, leading to low market participation
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, processors
Approaches to be used in dissemination	<ul style="list-style-type: none"> <li>• Farmer field and business Schools(FFBS)</li> <li>• Agricultural Innovation Platforms (AIP)</li> <li>• Trainings</li> <li>• Factsheets</li> <li>• Manuals</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A platform for interaction of Tomato value chain stakeholders</li> <li>• Improve technology</li> <li>• More land and more members</li> <li>• Farmers work with other groups</li> <li>• Farmers form new groups</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – Members of producer organization</li> <li>• County extension staff - Capacity building</li> <li>• NGOs – Capacity building</li> </ul>

	<ul style="list-style-type: none"> <li>• Private sector (local traders and exporters) – Targeted markets</li> <li>• Research institutions – Capacity building</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• Issues related to increasing production from existing group</li> <li>• Issues related to increasing production from increasing size of existing groups</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• 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</li> <li>• 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</li> </ul>
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – are there other farmers who want to join the group</li> <li>• Environmental conditions – would the increase in production come from improved technology</li> <li>• More land, or new members in the group</li> <li>• Policy conditions – Policies supporting formation and functioning of producer organizations</li> <li>• Market conditions – new markets</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> <li>• Women and youth are left out during the formation of tomatoes marketing and innovation platforms</li> <li>• Tomatoes stakeholders especially women might not be aware of marketing research since they are never included when such activities are being conducted</li> <li>• Some of the tomato stakeholders especially women might not be able to participate in market research due to their low level of education</li> <li>• Tomatoes stakeholders such as women do not get results acquired after market research of tomatoes is conducted since they have limited access to market information and agricultural extension services</li> </ul>

	<ul style="list-style-type: none"> <li>• Women are usually left out when key decisions are being made relating to the tomatoes value chain</li> <li>• There is need for involvement of all genders(men, women and youth) in tomato marketing organizations and committee</li> <li>• There is need to promote inclusion of youth, males and females during marketing dissemination workshops</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• There is potential of increased production and commercialization of tomatoes by women and youth</li> <li>• Increased employment of women and youths at various nodes of tomatoes value chain</li> <li>• There will be increased market information and market outlets for women and youth</li> <li>• There will be increased women and youth participation in tomatoes marketing research</li> </ul>
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs might not be able to participate in market research due to their limited mobility and exposure</li> <li>• Tomatoes stakeholders such as VMGs do not get results after market research of tomatoes is conducted since they have limited access to market information and agricultural extension services</li> <li>• VMGs are usually left out when key decisions are being made relating to marketing of tomatoes products hence they are exploited by middle men</li> <li>• VMGs are usually left out during the formation of tomatoes marketing groups hence they do not get new information relating to the value chain</li> <li>• The VMGs have limited finances which limits them from paying for services such as trainings and new materials relating to tomatoes marketing</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Increased production and sales of tomatoes by VMGs</li> <li>• There will be a potential of increased employment of VMGs at various nodes of tomatoes value chain</li> <li>• There will be increased market information and market outlets for women and youth</li> <li>• There will be increased VMGs participation in tomatoes marketing research</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for users	<ul style="list-style-type: none"> <li>• Training factsheets</li> <li>• Manuals</li> <li>• Power point slides are available</li> </ul>
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Requires validation
<b>G: Contacts</b>	

Contacts	Centre Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

## Research Gaps

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

<b>2.12.6 TIMP Name</b>	<b>Contracted tomato production system</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low productivity due to market failure in Tomato production, leading to low income and poor quality
What is it? (TIMP description)	Contract farming involves investment by the 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	Without contract farming smallholder farmers realize low prices for their produce. Contract farming is a contractual arrangement between producers and buyers of a farm product. The contract can either be oral or written, and will specify one or more conditions of production and marketing of an agricultural product. In essence, contract farming commits the farmer to produce a certain commodity at a certain time for an agreed price and, in return, the contractor undertakes to buy the commodity, and may provide agricultural extension and other services to producers in order to satisfy production requirements in terms of quality and quantity. The benefits of contract farming to farmers are market access, increased Incomes, reduction in the risk of price fluctuations, credit and financial intermediation, timely provision of inputs, monitoring and labour incentives, reduction of production risk, introduction of higher-value crops, improved collective bargaining, household spill-over benefits and improved access to extension. A written contract farming is recommended.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, extension, research institutions, farmer cooperative societies

Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), barazas, trainings, fFactsheets, manuals, media
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A platform for interaction of Tomato value chain stakeholders</li> <li>• Willing farmers</li> <li>• Availability of traders</li> <li>• Competitiveness of Tomato</li> <li>• Production volume</li> <li>• Enforcement</li> <li>• Bidding contract farming</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – Contract party and beneficiaries</li> <li>• County extension staff - Capacity building, signing contract</li> <li>• NGOs – Capacity building</li> <li>• Private sector (local traders and exporters) – Contract party and beneficiaries</li> <li>• Research institutions – Capacity building</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• Lack of Tomato innovation platforms to facilitate interaction of farmers with relevant stakeholders</li> <li>• Disorganization and scattered farmers</li> <li>• Small-scale farming</li> <li>• Lack of information by part of the producers</li> <li>• Level of policy support</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Establish Tomato innovation platforms</li> <li>• Formation of production clusters</li> <li>• Small-scale farming – Increase volume through increase in productivity</li> <li>• Capacity building</li> <li>• County policy formulation and enforcement for contract farming</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform</li> <li>• Availability of market</li> <li>• Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms</li> <li>• Increased benefits</li> </ul>
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – Conflicts with traditional farming</li> <li>• Environmental conditions – reduced environmental pollution through safe use of agrochemicals</li> </ul>

	<ul style="list-style-type: none"> <li>• Input support in the contract improves natural resource management</li> <li>• Policy conditions – Policy in formulation and enforcement</li> <li>• Market conditions – volume, place, price, promotion, traders</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women are usually left out when agricultural marketing groups and innovation platforms are being formed due to their social economic status in the society</li> <li>• Women have limited access to agricultural information and extension services hence they might not know of the existing tomatoes marketing groups</li> <li>• Women and youth have limited finances to pay services such as training unlike men due to limited access to credit facilities</li> <li>• In some cultures, women may not be able to travel away from their homes to producer group meetings, without permission</li> <li>• Strict rules of entry and requirements of producers' organizations may limit womens' participation</li> </ul>
Gender Opportunities	<ul style="list-style-type: none"> <li>• Improved access to market within and without</li> <li>• Increased market information and channels for women and youth hence increased job opportunities</li> <li>• Increased incomes for women and youth</li> <li>• Improved livelihoods for households</li> </ul>
VMGs issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• The VMGs have limited access to market information and external markets due to limited access to extension services so they might not be aware of tomatoes contracted marketing</li> <li>• Due to their social status VMGs are often excluded when tomatoes marketing groups are being formed</li> <li>• VMGs might not be aware of existing tomatoes marketing models such as contracted marketing. In addition, they might not be aware of the existing tomatoes marketing group and innovation platforms</li> <li>• VMGs are excluded when important decision making are being made relating to tomatoes production and marketing</li> <li>• VMGs also have limited participation and influence in rural producer organizations due to limited access to assets, resources and services, required for members to join marketing groups</li> </ul>

VMGs opportunities	<ul style="list-style-type: none"> <li>• Improved access to market within and without</li> <li>• There will be Increased market information and channels for VMGs hence increased job opportunities</li> <li>• Increased incomes for VMGs</li> <li>• Improved livelihoods for VMGs</li> <li>• There will be improved commercialization of tomatoes by the VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Centre Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

## Research Gaps

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

<b>2.12.7. TIMP Name</b>	<b>Marketing innovation model</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to the farmers' failure to apply entrepreneurship in the production and marketing of Tomato which also lead to low prices
What is it? (TIMP description)	Marketing innovation encompasses entrepreneurship where farmers undertake technology modification, finance and business acumen in an effort to transform innovations into economic goods and ultimately profit.
Justification	Marketing innovation involves product diversification. Diversification develops various marketing channels Failure to apply innovation in marketing of Tomato, the market outlook will be narrow
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, extension, NGOs, researchers.

Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), trainings, Factsheets, Manuals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A platform for interaction of Tomato value chain stakeholders</li> <li>• Organization of farmers</li> <li>• Availability of innovations</li> <li>• Achievement of profit</li> <li>• Access to finance</li> <li>• Availability of facilitators</li> <li>• Availability of many traders</li> <li>• Production volume and quality</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – Acceptability of innovations, county extension staff – Facilitators</li> <li>• NGOs – Facilitators, private sector (local traders and exporters) – Buyers</li> <li>• Research institutions – Facilitators</li> </ul>
VMG related opportunities	Increased production and sales of Tomato by VMGs leading to improved livelihood
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• Lack of Tomato innovation platforms to facilitate interaction of farmers with relevant stakeholders</li> <li>• Small-scale farming</li> <li>• Lack of market information</li> <li>• Low profitability in Tomato farming</li> <li>• :Lack of policy support</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Establish Tomato innovation platforms</li> <li>• Small-scale farming – capacity building to farmers</li> <li>• Availability of information on innovations</li> <li>• Profitable innovations</li> <li>• Strengthening county policy support</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform</li> <li>• Availability of market</li> <li>• Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms</li> <li>• Reduced cost of production increases profits,</li> </ul>
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – Conflicts with traditional methods</li> <li>• Environmental conditions – Use of pesticides and disposal</li> <li>• Market conditions – Contract farming</li> <li>• Access to inputs such as fertilizer</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	

Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> <li>• Women are usually left out when tomatoes marketing groups and innovation platforms are being formed due to their social economic status in the society</li> <li>• Women have limited access to agricultural information and extension such as marketing hence they might not be aware of the TIMP</li> <li>• Women do not have time to attend organized meetings due to their busy schedules hence reducing their chances of getting information on marketing innovation model for tomatoes</li> <li>• Women and youth have limited finances to pay services such as training unlike men due to limited access to credit facilities</li> <li>• In some cultures, women may not be able to travel away from their homes to producer group meetings, without permission</li> <li>• Strict rules of entry and requirements of producers' organizations may limit women participation</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Increased production and sales of tomatoes women and youth s</li> <li>• Increased market information and channels for women and youth hence increased job opportunities</li> <li>• There will be diversification of products sold by women and the youth</li> </ul>
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs are usually left out when tomatoes marketing groups and innovation platforms are being formed due to their social economic status in the society</li> <li>• VMGs have limited access to agricultural information and extension such as marketing hence they might not be aware of the TIMP</li> <li>• VMGs have limited finances to pay services such as training due to limited access to credit facilities</li> <li>• VMGs might not be aware of existing tomatoes marketing groups and innovation platforms</li> <li>• VMGs are excluded when important decision making are being made relating to tomatoes production and marketing</li> <li>• VMGs also have limited participation and influence in rural producer organizations due to limited access to assets, resources and services, required for members to join</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Increased production and sales of tomatoes by VMGs</li> <li>• Improved access to market within and without for VMGs</li> <li>• Increased market information and channels for VMGS hence increased job opportunities</li> <li>• There will be diversification of products sold by VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Increased income and diversification in investments

Application guidelines for users	Training factsheets, manuals and power point slides are available
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Centre Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

### Research Gaps

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

<b>2.12.8. TIMP Name</b>	<b>Digital marketing</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to the market inaccessibility among the smallholder farmers. The smallholder farmers have limited use of technologies among the smallholder farmers while linking to markets, leading to poor market access and constraints in marketing channels, skills and market information
What is it? (TIMP description)	Internet/mobile marketing refers to the online marketplace that provides buyers and sellers with an avenue to meet and exchange goods and services These can include a variety of online platforms, tools, and content delivery systems
Justification	Internet/mobile 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>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, processors
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), trainings, factsheets, manuals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A platform for interaction of Tomato value chain stakeholders</li> <li>• Education levels of the farmers and investors in Tomato production and profitability analysis</li> <li>• Levels of experiences in Tomato production</li> </ul>

	<ul style="list-style-type: none"> <li>• Availability of information on Tomato production and marketing</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – Sellers of Tomato production</li> <li>• County extension staff - Capacity building</li> <li>• NGOs – Capacity building</li> <li>• private sector (local traders and exporters) – Buyers of Tomato</li> <li>• Research institutions – Capacity building</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• Lack of Tomato innovation platforms to facilitate interaction of farmers with relevant stakeholders</li> <li>• Low digital skills of farmers</li> <li>• Unconsolidated produce for the market</li> <li>• Small-scale farming, inadequate information to stakeholders on the Tomato production and marketing and profitability</li> <li>• Limited internet connectivity</li> <li>• Levels of policy support on internet infrastructure</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Establish Tomato innovation platforms</li> <li>• Capacity building</li> <li>• Delivery of produce to the designated centres</li> <li>• Sensitization to appreciate need for consolidation of produce</li> <li>• Developing of information hubs</li> <li>• Upgrade internet connectivity and information hub</li> <li>• Policy support in internet infrastructure and utilization</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform</li> <li>• Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms requires stakeholders involvement</li> <li>• Remains the best cost effective option for marketing in terms of searching for the market information</li> </ul>
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – low levels of adoption of information technology, environmental conditions – improved internet connectivity</li> <li>• Policy conditions – Policy supporting information hubs</li> <li>• Market conditions – high costs of information technologies</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	

Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> <li>• Most women have limited knowledge on how to use internets to get tomatoes marketing information</li> <li>• Women are usually poor they do not have finances to purchase modern mobile devices and airtime</li> <li>• Women have limited finances to pay internet services unlike men due to limited access to credit facilities</li> <li>• Some of the tomatoes women farmers are semi- illiterate hence might not be able to understand the information acquired through the social media since it is usually in English or Swahili</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Improved accessibility of information by women, and the youth</li> <li>• Job creation for youth in availing information and in selling mobile phones</li> <li>• If adopted there will be increased tomatoes markets local and distance for women and the youth</li> <li>• There will be improved production of tomatoes for women hence improved livelihoods for households</li> <li>• There will be improved food security and nutrition for women</li> </ul>
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited knowledge on how to use internets to get tomatoes marketing information</li> <li>• VMGs are usually poor they do not have finances to purchase modern mobile devices and airtime due to limited access to credit facilities</li> <li>• Internet services are usually allocated in small rural towns which might be far from the residiatial places of the VMGs this being the case VMGs who do not have Mobile devices might not be able to have access to the services due to their limited mobility</li> <li>• In addition, VMGs have no finances to pay for internet services due to limited access to credit facilities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Improved accessibility of information by the VMGs if the TIMP is adopted</li> <li>• Job creation for VMGs in availing information and in selling mobile phones</li> <li>• If the TIMP is adopted there will be increased local and distance tomatoes markets for VMGs</li> <li>• There will be improved production and commercialization of tomatoes by VMGs leading to improved livelihoods</li> <li>• There will be improved food security and nutrition for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	

Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2, Requires validation, 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

## Research Gaps

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

## 2.13 Agricultural Policy Options

<b>2.13.1 TIMP Name</b>	<b>Framing Tomato production in the National Agricultural Policy</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to limited policy support in inputs and outputs markets. The smallholder farmers are inaccessible to inputs and outputs markets. The instruments and the rules to achieve the policy productivity objectives are inappropriate for the smallholder farmers of Tomato production but instead favour the large scale farmers in Kenya. Moreover, the smallholder farmers of Tomato are not aware of the instruments and rules for achieving productivity objectives.
What is it? (TIMP description)	The National Agricultural policy strategy framework provides instruments and rules for the smallholder farmers to increase Tomato productivity in the Counties..
Justification	Agricultural policymaking in Kenya overlook diverse agricultural transformation pathways that are sustainable in local social/material conditions and based on smallholder farmers' knowledge 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>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, policy makers, traders, processing industries, extension, NGOs, research institutions, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP),
Approaches to be used in dissemination	Meetings, radio, television, social media (WhatsApp, Facebook, twitter), Internet, farmers’ groups
Critical/essential factors for successful promotion	Availability of stakeholders, availability of specific Tomato-based policies
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – Demanding Tomato policies to support production and marketing</li> <li>• County extension staff - Sensitization of farmers</li> <li>• NGOs – Sensitization of farmers</li> <li>• Private sector (local traders and exporters) – Demanding Tomato policies to support production and marketing</li> <li>• Research institutions – Sensitization of stakeholders</li> <li>• Policy makers – Assist in policy making</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• <b>Value Chain:</b> Tomato yields remain low and total domestic production is unable to satisfy demand by manufacturers leading to growing imports of raw materials.</li> <li>• <b>Standards:</b> 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.</li> <li>• <b>Aggregation:</b> Aggregation models including cooperatives—suffered after the downturn in Tomato production, wherein many farmers abandoned Tomato production. These weak organizations provide few services to farmers while providing limited bargaining power.</li> <li>• <b>Financial Incentives:</b> The government provides only limited support to Tomato 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 and financing access to inputs.</li> </ul>

	<p>However, none of these efforts are explicitly tied to environmental or CSA standards.</p>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• <b>Value Chain:</b> 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.</li> <li>• <b>Standards:</b> Existing Tomato 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. <b>Aggregation:</b> Partnerships between farmer cooperatives and Tomato producers can strengthen market linkages, set guaranteed prices for farmers, and enable access to resilient, high-yielding seeds and other climate-smart inputs.</li> <li>• <b>Financial Incentives:</b> 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 Tomato payments, including CSA-criteria, while offering comprehensive service provision for producers through public-private partnerships. Building public-private partnerships is key to filling service gaps for smallholders to improve productivity and disseminate CSA practices.</li> </ul>
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – Traditional farming of Tomato where there is no value chain</li> <li>• Environmental conditions – Use of pesticides</li> <li>• Policy conditions – Lacking specific Tomato policy, market conditions - Poor market infrastructure</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> <li>• Tomatoes stakeholders especially women might not be aware of the existing policies relating to the sale of inputs and marketing of the products</li> <li>• Tomatoes are usually produced by small scales farmers majority of them being women and they are usually left out when important decisions are being made relating to production and marketing of tomatoes</li> <li>• Women and youth have limited access to agricultural information and extension services hence might not be aware of existing agricultural policies</li> </ul>

	<ul style="list-style-type: none"> <li>• Tomatoes are usually produced by women who have low education and they might not be able to read and interpret policy documents</li> <li>• Women and youth lack Access and control of productive resources such as land, equipment and credit facilities hence they might have resources required to attend policy consultative meetings</li> <li>• Policies relating to tomatoes value chain should support youth, females and males in production and marketing of tomatoes products</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• There will be increased support of women and youth in production and marketing of tomatoes</li> <li>• Increased income for youth female and male</li> <li>• Increased employment for youth, females and males</li> <li>• There will be policies working for the benefit of farmers and not against</li> </ul>
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Tomatoe stakeholders especially the VMGs might not be aware of the existing policies relating to the sale of inputs and marketing of the products</li> <li>• VMGs are usually left out when important decisions are being made relating to production and marketing of tomatoes</li> <li>• VMGs are not aware of existing agricultural policies especially relating to tomatoes value chain due to limited access to agricultural information and extension</li> <li>• Most of the VMGs involved in tomatoes value chain have low education and they might not be able to read and interpret policy documents</li> <li>• VMGs have limited access and control of productive resources such as land, equipment and credit facilities hence they might have resources required to attend policy consultative meetings</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• There will be increased support of VMGs in production and marketing of tomatoes</li> <li>• There will be increased income for VMGs</li> <li>• There will be policies working for the benefit of farmers and not against</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Ready for upscaling
<b>G: Contacts</b>	
Contacts	Centre Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294

Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

### Research Gaps

- Adoption of policies
- Equity distribution among the stakeholders
- Productivity levels among the smallholder farmers of Tomato
- Farmer accessibility to production inputs
- Impact on Tomato prices

<b>2.13.2 TIMP Name</b>	<b>Participation in County Integrated Development Planning</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to limited participation of the smallholder farmers of Tomato during County development planning. Based on that, there is lack of County integration of Tomato production and marketing during planning.
What is it? (TIMP description)	The County Integrated Development Planning builds a plan for each county in Kenya to be implemented in five years. The planning process is participatory, involving the development stakeholders in the county. It is during this planning period where the issues in Tomato production, marketing and processing are considered.
Justification	In the Counties where the Tomato value chain creates wealth among the smallholder farmers, centralization of the farmers agency and voices during the County Integrated Developing Planning is need. Failure to plan for the Tomato production would to less optimization of opportunities
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, processing industries, extension, NGOs, research institutions, policy makers
Approaches to be used in dissemination	Farmer field and business Schools(FFBS), Agricultural Innovation Platforms (AIP), meetings, radio, television, social media (WhatsApp, Facebook, twitter), Internet, farmers' groups
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Availability of stakeholders</li> <li>• Availability of agricultural policies and specific Tomato-based policies</li> <li>• Issues in Tomato business</li> <li>• Specific policy objective statement</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – Demanding Tomato policies to support production and marketing</li> <li>• County extension staff - Sensitization of farmers</li> <li>• NGOs – Sensitization of farmers</li> </ul>

	<ul style="list-style-type: none"> <li>Private sector (local traders and exporters) – Demanding Tomato policies to support production and marketing</li> <li>Research institutions – Sensitization of stakeholders</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Promoted in Kirinyaga County and has been widely adopted across other major tomato growing areas such as Kajiado County
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>Disorganization and scattered farmers</li> <li>Small-scale farming</li> <li>Inadequate information to stakeholders on the agricultural policies whether National or County</li> <li>Poorly established Tomato value chain</li> <li>Tomato production are specific to agro-ecological zones and not all the Counties in Kenya grow Tomato</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>Disorganization and scattered farmers – Formation of producer organizations as an institution</li> <li>Small-scale farming – Policies for increasing productivity</li> <li>Inadequate information to stakeholders on the agricultural policies whether National or County – Sensitization of stakeholders</li> <li>Poorly established Tomato value chain – strengthening Tomato value chain</li> <li>Tomato production are specific to agroecological zones and not all the Counties in Kenya grow Tomato – Diversification of Tomato</li> </ul>
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>Social conditions – Acceptability of the policies</li> <li>Environmental conditions – lack of a comprehensive land use policy</li> <li>Policy conditions – Lacking specific Tomato policy, market conditions - Poor market infrastructure</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development and dissemination, adoption and scaling	<p>Women might not have adequate information on the CIDP due to their low level of education</p> <p>Women and youth are discriminated against when important decisions are being held relating to development at all levels</p> <ul style="list-style-type: none"> <li>Women may not be able to travel away from their homes to attend trainings meetings, without permission so they are not</li> </ul>

	<p>able to participate in policy stakeholder’s meetings relating to agricultural value chains such as tomatoes</p> <ul style="list-style-type: none"> <li>• Women are limited from participating in agricultural meetings as they lack finances to pay for transport if the meetings are held far from their localities</li> <li>• Women are usually left out when key decisions are being made starting from the household to the County level due to their low social status in the society</li> <li>• The county need to encourage inclusion of all members of the community including: the poor, men, women, physically challenged, youth, vulnerable and marginalized groups</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• There will be improved policies supporting youth, females and males in the production and marketing of tomatoes</li> <li>• There will be increased incomes for women and youth</li> <li>• Increased employment by youth, females and males</li> <li>• There will be increased participation of all genders in tomatoes production and marketing</li> <li>• There be increased employment for all genders at various nodes of tomatoes value chain</li> </ul>
VMG issues and concerns in development and dissemination, adoption and scaling up	<p>VMGs may not be able to travel away from their homes to attend trainings meetings, due to their physical challenges and also lack of finances to pay for their transport hence have limited knowledge on CIDP</p> <p>VMGs are discriminated against when important decisions are being held relating to development at all levels</p> <p>VMGs are excluded from participating when important meetings and workshops are being held relating to agricultural information and dissemination</p> <p>VMGs have limited access to agricultural information and extension services hence they might not have adequate information of the County programmes</p>
VMG related opportunities	<ul style="list-style-type: none"> <li>• There will be increased support of the VMGs in the production and marketing of tomatoes</li> <li>• There will be increased income for VMGs</li> <li>• There is potential of increasing employment for VMGs at every node of tomatoes value chain</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Ready for upscaling
<b>G: Contacts</b>	
Contacts	Centre Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a>

	Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

### Research Gaps

- Adoption of policy options
- Equity distribution among the stakeholders
- Productivity levels among the smallholder farmers
- Farmer accessibility to production inputs

<b>2.13.3 TIMP Name</b>	<b>Policy instruments related to tomato</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to the existing policy instruments which fail to support the smallholder farmers' issues in Tomato production and marketing. Therefore, weak policy instruments have led to the market failure for both inputs and outputs
What is it? (TIMP description)	The policy instruments are the means to achieve policy objectives. For the Tomato production, some of the policy instruments include subsidy in the inputs and also minimum price for the Tomato outputs.
Justification	Without policy instruments the Tomato productivity will remain low. It is very likely that a particular policy instrument, although designed to have primarily an efficiency, distributive, or stability effect, will also have some impact on the other objectives related to Tomato production
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, processing industries, extension, NGOs, research institutions, policy makers
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), meetings, radio, television, social media (WhatsApp, Facebook, twitter), Internet, farmers' groups
Critical/essential factors for successful promotion	Availability of policy objectives, availability of policy instruments
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers – beneficiaries of policy instruments</li> <li>• County extension staff - Sensitization of farmers</li> <li>• NGOs – Sensitization of farmers</li> <li>• Private sector (local traders and exporters) – beneficiaries</li> <li>• Research institutions – Sensitization of stakeholders</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Promoted in Kirinyaga County and has been widely adopted across other major tomato growing areas such as Kajiado County

Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• Disorganization and scattered farmers</li> <li>• Small-scale farming</li> <li>• Inadequate information to stakeholders on the agricultural policies whether National or County</li> <li>• Poorly established Tomato value chain</li> <li>• Tomato production are specific to agro-ecological zones and not all the Counties in Kenya grow Tomato</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Disorganization and scattered farmers – Formation of producer organizations as an institution</li> <li>• Small-scale farming – Policies for increasing productivity</li> <li>• Inadequate information to stakeholders on the agricultural policies whether National or County – Sensitization of stakeholders</li> <li>• Poorly established Tomato value chain – strengthening Tomato value chain</li> <li>• Tomato production are specific to agro-ecological zones and not all the Counties in Kenya grow Tomato – Diversification of Tomato</li> </ul>
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – Low understanding of policy instruments</li> <li>• Environmental conditions – lack of a comprehensive land use policy</li> <li>• Policy conditions – Lacking specific Tomato policy</li> <li>• Market conditions - Poor market infrastructure</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development and dissemination, adoption and scaling	<ul style="list-style-type: none"> <li>• Tomatoes stakeholders especially women might not be aware of the policy cycles since women are never involved when important meetings are being discussed.</li> <li>• Women might not have adequate information on the existing tomatoes policies due to their low level of education</li> <li>• Women and youth are discriminated against when important decisions are being held relating to development at all levels</li> <li>• Women may not be able to travel away from their homes to attend trainings meetings, without permission so they are not able to participate in policy stakeholders meetings relating to agricultural production</li> </ul>

	<ul style="list-style-type: none"> <li>• Women are limited from participating in agricultural meetings as they lack finances to pay for transport if the meetings are held far from their localities</li> <li>• In marketing of tomatoes women and youth face exploitation from middle men because they are not aware of the policies guiding production and marketing of the products even at the county level</li> <li>• Women are usually left out when key decisions are made relating starting from the household to the County level</li> <li>• The county need to encourage inclusion of all members of the community including: the poor, men, women, physically challenged, youth, vulnerable and marginalized groups</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• There will be improved policies supporting all tomatoes stakeholders in the production and marketing of tomatoes</li> <li>• There will be increased incomes for women and youth</li> <li>• There will be increased participation of all genders in tomatoes production and marketing</li> <li>• There be increased employment for all genders at various nodes of tomatoes value chain</li> </ul>
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs are left out when key decisions are being made relating to production and marketing of agricultural products</li> <li>• VMGs are not aware of existing agricultural policies especially relating to tomatoes chain due to limited access to agricultural information and extension</li> <li>• VMGs are excluded from participating when important meetings and workshops are being held relating to agricultural information and dissemination</li> <li>• VMGs may not be able to travel away from their homes to attend policy stakeholder meetings, due to their physical challenges and also lack of finances to pay for their transport</li> <li>• There is need to promote inclusion of all members of the community including: the poor, men, women, physically challenged, youth, vulnerable and marginalized groups</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• There will be improved policies supporting VMGs in the production and marketing of tomatoes</li> <li>• There will be increased incomes for VMGs</li> <li>• There be increased employment for VMGs at various nodes of tomatoes value chain</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	Ready for upscaling

<b>G: Contacts</b>	
Contacts	Centre Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

### Research Gaps

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

<b>2.13.4 TIMP Name</b>	<b>Policy cycle</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Low Tomato productivity due to the development of agricultural policies not relevant to the problem emergency in Tomato and also without staged follow-up.
What is it? (TIMP description)	The policy process is normally conceptualized as sequential parts or stages. These are (1) problem emergence, (2) agenda setting, (3) consideration of policy options, (3) decision-making, (5) implementation, and (6) evaluation. 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 provide a frame work and antedates any forthcoming issues related to policy development. The policy <i>cycle</i> is usually divided into five stages: agenda setting, formulation, implementation, and evaluation
Justification	Why is a policy cycle an appropriate tool for making policies related to Tomato? The policy cycle creates the need for a policy based on the agricultural problem emergence/issues. The policy cycle is an idealized process that explains how policy should be drafted, implemented and assessed. It serves more as an instructive guide for those new to policy than as a practical strictly-defined process, but many organizations aim to complete policies using the policy cycle as an optimal model. Policy cycle is a valuable 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.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	

Users of TIMP	Farmers, traders, processing industries, extension, NGOs, research institutions
Approaches to be used in dissemination	<ul style="list-style-type: none"> <li>• Farmer field and business Schools (FFBS)</li> <li>• Agricultural Innovation Platforms (AIP)</li> <li>• Meetings</li> <li>• Radio</li> <li>• Television</li> <li>• Social media (WhatsApp, Facebook, twitter)</li> <li>• Internet</li> <li>• Farmers' groups</li> </ul>
Critical/essential factors for successful promotion	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"> <li>• Farmers – generate issues, county extension staff - capacity building</li> <li>• NGOs – capacity building, private sector (local traders and exporters) – generate issues</li> <li>• Research institutions – capacity building, policy makers</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMPs will be upscaled	Kajiado, Elgeyo Marakwet, Garissa, Mandera, Siaya
Challenges in development and dissemination -	<ul style="list-style-type: none"> <li>• Disorganization and scattered farmers</li> <li>• Small-scale farming, inadequate information to stakeholders on issues</li> <li>• Poorly established Tomato value chain</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Disorganization and scattered farmers – issues on formation of producer organizations as an institution</li> <li>• Small-scale farming – issues on aggregation</li> <li>• Inadequate information to stakeholders – Sensitization on the roles of each policy cycle stages</li> <li>• Poorly established Tomato value chain – strengthening Tomato value chain</li> </ul>
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Social conditions – Different issues among the Tomato producers</li> <li>• Environmental conditions – environmental issues</li> <li>• Policy conditions – Lacking specific Tomato policy</li> <li>• Market conditions – Market issues</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Total variable cost per acre per crop cycle KES 46,700
Estimated returns	Total gross revenue per acre per crop cycle KES 280,000. Gross margin per acre per crop cycle KES 233,300, depending on Tomato variety
Gender issues and concerns in development and	Women might not have adequate information on the existing tomatoes policies due to their low level of education

dissemination, adoption and scaling	<p>Women and youth are discriminated against when important decisions are being held relating to development at all levels</p> <ul style="list-style-type: none"> <li>• Women may not be able to travel away from their homes to attend trainings meetings, without permission so they are not able to participate in policy stakeholders meetings relating to agricultural production</li> <li>• Women are limited from participating in agricultural meetings as they lack finances to pay for transport if the meetings are held far from their localities</li> <li>• In marketing of tomatoes women and youth face exploitation from middle men because they are not aware of the policies guiding production and marketing of the products even at the county level</li> <li>• Women are usually left out when key decisions are made relating starting from the household to the County level</li> <li>• The county need to encourage inclusion of all members of the community including: the poor, men, women, physically challenged, youth, vulnerable and marginalized groups</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• There will be improved policies supporting all tomatoes stakeholders including women in the production and marketing of tomatoes</li> <li>• There will be increased incomes for women and youth</li> <li>• Increased employment by youth, females and males</li> <li>• There will be increased participation of all genders when important decisions are being made relating to tomatoes value chain</li> <li>• There be increased employment for all genders at various nodes of tomatoes value chain</li> <li>• Problems experienced by women and youth relating to the production and marketing of tomatoes will be addressed</li> </ul>
VMG issues and concerns in development and dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs are left out when key decisions are being made relating to production and marketing of agricultural value chains such as tomatoes</li> <li>• VMGs are not aware of existing agricultural policies especially relating to tomatoes value chain due to limited access to agricultural information and extension</li> <li>• VMGs are excluded from participating when important meetings and workshops are being held relating to agricultural information and dissemination</li> <li>• VMGs may not be able to travel away from their homes to attend policy stakeholder meetings , due to their physical challenges and also lack of finances to pay for their transport</li> <li>• There is need to promote inclusion of all members of the community including: the poor, men, women, physically challenged, youth, vulnerable and marginalized groups</li> </ul>

VMG related opportunities	<ul style="list-style-type: none"> <li>• There will be improved policies supporting VMGs in the production and marketing of tomatoes</li> <li>• There will be increased incomes for VMGs</li> <li>• There be increased employment for VMGs at various nodes of tomatoes value chain</li> <li>• There will be inclusivity of VMGs when important decisions are being made relating to tomatoes value chain</li> <li>• Problems relating to the production and marketing of tomatoes will be addressed</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	None
Application guidelines for users	Training factsheets, manuals and power point slides are available
<b>F: Status of TIMP Readiness</b> (1. Ready for upscaling, 2. Requires validation, 3. Requires further research)	
	Requires validation
<b>G: Contacts</b>	
Contacts	Centre Director, KALRO-Katumani P.O. Box 340-90100 Machakos <a href="mailto:cd.katumani@kalro.org">cd.katumani@kalro.org</a> Phone: 0736333294
Lead organization/scientists	KALRO; Wambua, J,M,
Partner organizations	Ministry of Agriculture, Livestock, Fisheries and Irrigation, Farmers

### Research Gaps

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



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