



INVENTORY OF CLIMATE SMART AGRICULTURE TOMATO TECHNOLOGIES, INNOVATIONS AND MANAGEMENT PRACTICES

Compiled by

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1.0 Definition of terms and summary tables of Tomato Technologies, Innovations and Management Practices (TIMPS)

1.1 Definition of terms

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

Management practice: This is defined as recommendation(s) on practice(s) that is/are considered necessary for a technology to achieve its optimum output. These include, for instance, different agronomic 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 59 TIMPs including 28 technologies, 3 innovations and 28 management practices, distributed among the 7 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	12	0	0
Tomato	Agronomic practices	5	0	8
Tomato	Physiological Disorders	1	0	1
Tomato	Pests and Diseases	5	3	15
Tomato	Harvesting practices	0	0	2
Tomato	Postharvest handling	3	0	2
Tomato	Value addition	2	0	0
Overall Total		28	3	28

1.3 Summary of Status of TIMPs in Tomato Value Chain

The inventory process resulted in a total of 27 TIMPs that are ready for up-scaling, 29 TIMPs that require validation and 9 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	1*
Tomato	Agronomic practices	7	6	3*
Tomato	Physiological Disorders	2	0	0
Tomato	Pests and Diseases	13	7	4*
Tomato	Harvesting practices	2	0	0
Tomato	Postharvest handling	2	3	
Tomato	Value addition	1	1	1*
Overall Total		27	29	9

Table3: Inventory of Tomato TIMPs by Category and Status

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
2.1 Improved varieties	Tomato varieties for open field		
	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
	Tomato varieties for Greenhouse cultivation	Technology	Requires validation
	2.1.6 Anna F1	Technology	Requires validation
	2.1.7 Tylka F1,	Technology	Requires validation
	2.1.8 Chonto F1	Technology	Requires validation
	2.1.9 Bravo F1)	Technology	Requires validation
	2.1.10 Mavuno F1	Technology	Requires validation
	Cherry tomato varieties		
	2.1.11 Koko (JKUAT)	Technology	Requires validation
2.1.12 Chika (JKUAT)	Technology	Requires validation	
2.2 Agronomic practices	Open field tomato cultivation		
	2.2.1 Raising clean Tomato seedlings in Nursery beds	Management practice	Ready for up-scaling
	2.2.2 Recommended spacing in open field	Management Practice	Ready for up-scaling
	2.2.3 Nutrition management	Management Practice	Ready for up-scaling
	2.2.4 Drip irrigation	Management practice	Ready for up-scaling
	2.2.5 Staking and Pruning in open field	Management practice	Ready for up-scaling
	2.2.6 Bio-degradable Mulching materials for weed management and moisture retention	Management practice	Validation
	Greenhouse Tomato cultivation		
	2.2.7 Improved greenhouses for production of high quality tomatoes (JKUAT)	Technology	Validation
	2.2.8 Coco-peat based intensive tomato production (JKUAT)	Technology	Validation
	2.2.9 Raising clean Tomato Seedlings in germination trays in greenhouse	Management Practice	Ready up-scaling
	2.2.10 Styrofoam based intensive tomato production (JKUAT)	Technology	Validation
	2.2.11 Capillary wick based irrigation system (JKUAT)	Technology	Validation
	2.2.12 Improved management practices for cherry tomatoes (JKUAT)	Management Practice	Validation
2.3 Physiological disorders	2.3.1 Management of Blossom end rot	Management Practice	Ready for up-scaling

	2.3.2 Shade-net tomato cultivation for management of sunscald	Technology	Ready for up-scaling
2.4 Pests and Diseases	2.4.1 Scouting for pests identification and control	Management Practice	Ready for up-scaling
	2.4.2 Integrated Pest Management control practices	Management Practice	Validation
	2.4.3 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
	2.4.5 Management of African bollworm, <i>Helicoverpa armigera</i> Hb by use of integrated control practices	Management Practice	Ready for up-scaling
	2.4.6 Management of Red spider mites, <i>Tetranychus</i> spp. by use of integrated control practices.	Management Practice	Ready for up-scaling
	2.4.7 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
	2.4.8 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
	2.4.9 Management of pests in tomato by use of agri-nets	Innovation	Ready for up-scaling
	2.4.10 Evaluation of pesticides for effectiveness in control of economic important pests for tomato	Management Practices	Ready for up-scaling
	2.4.11 Pesticides for management of insect pests	Management Practices	Ready for up-scaling
	2.4.12 Safe use of pesticides	Management Practices	Ready for up-scaling
	2.4.13 Use of plant extracts for control of tomato pests	Innovation	Requires further research
	2.4.14 Intercropping of tomatoes with garlic and onions to control pests	Technology	Requires further research
	2.4.15 Soil Solarization	Technology	Ready for up-scaling
	2.4.16 Management of Early blight (<i>Alternaria solani</i>) by use of milk	Innovation	Requires further research
	2.4.17 Crop rotation as a means of controlling diseases in tomatoes	Management Practice	Validation
	2.4.18 Field sanitation as a means of controlling disease incidences	Management Practice	Ready for up-scaling
	2.4.19 Evaluation of fungicides for effectiveness in control of economic important diseases for tomato	Management Practice	Requires further research
	2.4.20 Tomato Grafting	Innovation	Requires validation
	2.4.21 Disease resistant varieties	Technology	Requires validation
2.4.22 Bio-control	Technology	Requires validation	

	2.4.23 Trap crops	Technology	Requires validation
	2.4.24 Seed dressing for early pest management	Management practice	Requires validation
	2.4.25 Quarantine and movement restriction for management of pest and diseases	Management Practice	Ready for up-scaling
2.5 Harvesting Practices	2.5.1 Maturity indices	Management Practice	Ready for up-scaling
	2.5.2 Harvesting Procedure	Management Practice	Ready for up-scaling
2.6 Postharvest handling	2.6.1 Postharvest handling practices	Management Practice	Ready for up-scaling
	2.6.2 Improved packaging for Cherry tomatoes JKUAT	Management Practice	Validation
	2.6.3 Modified atmospheric packaging to extend shelf-life	Technology	Validation
	2.6.4 Zero-energy cooling unit for tomato storage	Technology	Validation
	2.6.5 Charcoal cooler for tomato storage	Technology	Ready for up-scaling
2.7 Value Addition	2.7.1 Processing of tomato into pulp	Technology	Ready for up-scaling
	2.7.2 Solar drier for dehydration of tomato	Technology	Validation

2.0 Detailed Tomato Value chain TIMPS

2.1. Improved varieties

2.1.1 TIMP Name	Rio-Grande
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of superior tomato varieties adapted to local conditions with acceptable fruit characteristics
What is it? (TIMP description)	Rio-Grande is a popular tomato variety suitable for irrigated open field cultivation with good market preference. It is determinate in growth habit, matures in 75-80 days after transplanting, produces elongated pear-shaped, bright red, pulpy fruit weighing 74gm on average and has a potential yield of 84t/ha. It performs best in medium to lower-medium zones in major tomato growing areas such as Mwea in Kirinyaga County, Ngurumani in Kajiado County and parts of Rift Valley and Western regions.
Justification	Rio-Grande is a popular determinate variety that requires minimal staking and is suitable for open-field cultivation under rain-fed and irrigated regimes. It is one of the best varieties for hot climates and is therefore suitable for dry areas where irrigation water is available. It matures in four months hence fits within one growing season, is tolerant to Fusarium and Verticillium wilts and has a high yield of 84 T/ha. It produces medium to large quality bright red pulpy firm fruit with a long shelf life of up to 3 weeks and transports well. These factors make it suitable for growing even in far flung marginal areas and can be transported to distant markets while still in wholesome condition. The fruit characteristics make it suitable for both fresh market and processing. It is an open-pollinated variety and seeds are therefore affordable to resource poor farmers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension agents, traders, processors
Approaches used in dissemination	Stakeholder training, field demonstrations, farmer field schools, Radio/TV broadcasts, shows, trade fairs
Critical/essential factors for successful promotion	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 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
C: Current situation and future scaling up	
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	- Future scaling up in Siaya, Elgeyo-Marakwet, Garissa and Mandera,
Challenges in dissemination	- The variety has not been evaluated for tolerance to heat stress which is a constraint in the new target areas - It is not tolerant to emerging pests e.g. <i>Tuta absoluta</i>
Suggestions for addressing the challenges	- It is necessary to evaluate variety for heat stress tolerance and acceptable characteristics in target areas
Lessons learned in up-scaling if any	- Previous works have identified that Farmer participatory approach works
Social, environmental, policy and market conditions necessary for up-scaling	- Organized marketing channels are critical for benefits to be derived from technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	- KES 155,000/ha (Total variable costs); - Seed cost: KES 15,000/ha
Estimated returns	- KES 750,000/ha Gross margin
Gender issues and concerns in development, dissemination, adoption and scaling up	- Decision making is largely done by men and this may affect adoption of the technology. Women may be disadvantaged through lack of access to land to engage in tomato cultivation.
Gender related opportunities	- The technology can be a good commercial enterprise across genders. - Tomato production has high returns when the timing is right and thus provides more income for sharing within the house hold across all genders.
VMG issues and concerns in development, dissemination, adoption and scaling up	- VMGs are rarely in farmer groups and are therefore disadvantaged in upscaling, training and financing - Lack of access to land and credit especially for the youth may limit their participation in tomato production.
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
E: Case studies/profiles of success stories	

Success stories from previous similar projects	<ul style="list-style-type: none"> -Contact farmers in Mwea who participated in the initial demonstrations of the variety have upgraded livelihood -Some of the youth (farmer's sons) adopted tomato growing in land allocated to them prompted by the demonstrations of the variety in parent's farm -Impact studies conducted after the end of USAID-MIAC/SO7/ADSP projects indicated that 70% of tomato seed sales in project pilot areas were of the new varieties promoted e.g. Rio-grande - Baseline study conducted in Kajiado County under KOPIA Vegetable Project in 2018, indicated that Rio-Grande variety was among the main tomato varieties grown by 22% of the farmers in open field under irrigation.
Application guidelines for users	Tomato cultivation manual and brochure with descriptor of the variety are documented
F: Status of TIMP (1. Ready for upscaling 2. Requires validation 3. Requires further research	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO, Agnes Ndegwa, Rebecca Faraay, Rahab Magoti
Partner organizations	Royal Seed Co Ltd. Simlaws Seed Co. Ltd; MoALF&I

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.

3.

2.1.2 TIMP Name	Cal-J
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of superior tomato varieties adapted to local conditions with acceptable fruit characteristics
What is it? (TIMP description)	Cal J is popular open-pollinated tomato variety suitable for open field cultivation in warm climates under rainfed and supplementary irrigation regimes. It is determinate in growth habit, does not require staking and matures in 70-75 days with a yield potential of 70 T/ha. Fruits weigh 68g on average, are deep red, blocky oval to round in shape and firm with a shelf life of upto 21 days when harvested at breaker stage.
Justification	Cal J has determinate growth and matures in 70-75 days after transplanting fitting well within growing season and give yields of up to 70 t/ha. It does not require staking and therefore saves on labour and resources for buying stakes. It is an open pollinated variety whose seeds are readily available from seed agents at an affordable cost. It is suitable for open field cultivation and is also tolerant to some of the problematic tomato diseases. Fruits are oval-round and firm with deep red colour that make the variety suitable for the fresh market and processing. These attributes of the variety make it a preferable choice by resource poor farmers in tomato growing areas across varied rain-fed regimes and also under irrigation.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, processors
Approaches used in dissemination	Stakeholder training, field demonstrations, farmer field schools, Radio/TV broadcasts, 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	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

C: Current situation and future scaling up	
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	- Future scaling up is targeted in Siaya, Elgeyo-Marakwet, Garissa, Mandera and West Pokot
Challenges in dissemination	- The variety has not been evaluated for tolerance to heat stress which is a constraint in the new target areas - It is not tolerant to emerging pests e.g. <i>Tuta absoluta</i>
Suggestions for addressing the challenges	- The variety should be evaluated for tolerance to heat stress in target areas
Lessons learned	- Previous research has shown that farmer participatory approach works
Social, environmental, policy and market conditions necessary for up-scaling	- Organized marketing channels critical for benefits to be derived from technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	- KES 155,000/ha (Total variable costs); Seed cost
Estimated returns	- KES 750,000/ha gross margin
Gender issues and concerns in development dissemination, adoption and up-scaling	- The variety can be easily grown by all gender categories and can be a good commercial enterprise - Some gender categories (e.g. youth and women) may be disadvantaged by lack of access to land for tomato cultivation
Gender related opportunities	- All gender categories can participate in growing the tomato variety
VMG issues and concerns in development dissemination, adoption and up-scaling	- Inclusivity of VMGs in tomato growing should be promoted avoid perpetuation of their marginalization - The VMGs may be disadvantaged due to lack of access to land and credit for tomato production
VMG related opportunities	- The tomato variety has nutritious attributes and antioxidant properties which would be beneficial especially to health challenged groups if engaged in growing and use - Growing the variety has potential as a lucrative enterprise for VMGs to be gainfully engaged
E: Case studies/profiles of success stories	
Success stories from previous similar projects	- Contact farmers in Mwea who participated in the initial demonstrations of the variety have upgraded livelihood - Some of the youth (farmer's sons) adopted tomato growing in land allocated to them prompted by the demonstrations of the variety in parent's farm - Impact studies conducted after the end of USAID-MIAC/SO7/ADSP projects indicated that 70% of tomato

	<p>seed sales in project pilot areas were of the new varieties promoted e.g. Cal J</p> <ul style="list-style-type: none"> - 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	- Tomato cultivation manual and brochure with descriptor of this variety are documented
F: Status of TIMP (1. Ready for upscaling 2. Requires validation 3. Requires further research	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO, Agnes Ndegwa, Rebecca Faraay
Partner organizations	Royal Seed Co Ltd. Simlaws Seed Co. Ltd; MoALF&I

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.

3.

2.1.3 TIMP Name	Onyx F1
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of superior tomato varieties adapted to local conditions with acceptable fruit characteristics
What is it? (TIMP description)	Onyx F1 is an excellent hybrid tomato variety suitable for open field cultivation in medium to lower medium zones. It is determinate in growth habit, does not require staking and produces firm, oval-round fruits with deep red color when fully ripe. It matures in 70 days from transplanting, has an average fruit weight of 105gm and yield potential of 45t/ha depending on level of crop management. Fruits have a shelf life of upto 21 days and transport well to distant markets.
Justification	The hybrid is an improvement of the earlier “Onyx” variety and has added attributes that include early maturity, higher yields and very firm fruit with an excellent shelf-life. It has been widely adopted in major tomato growing areas and is very popular in the market. The variety requires testing for adaptability in the target areas
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension service providers, County Government, Farmer groups/CBOs and NGOs traders, processors
Approaches used in dissemination	Stakeholder training, field demonstrations, farmer field schools, Radio/TV broadcasts, 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
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
C: Current situation and future scaling up	

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	- Future scaling up in: Siaya, Elgeyo-Marakwet, Garissa, Mandera, West Pokot
Challenges in dissemination	- The variety has not been evaluated for adaptability in the new target areas for example tolerance to heat stress which is a constraint - It is not tolerant to emerging pests e.g. <i>Tuta absoluta</i>
Suggestions for addressing the challenges	- There is need to evaluate the variety for heat stress tolerance and acceptable characteristics in target areas
Lessons learned in up-scaling if any	- Previous research indicates that farmer participatory varietal evaluation approach works and enhances adoption
Social, environmental, policy and market conditions necessary for up-scaling	- Organized marketing channels are critical for benefits to be derived from technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 155,000/ha (Total variable costs)
Estimated returns	KES 750,000/ha gross margin
Gender issues and concerns in development, dissemination, adoption and scaling up	- Some gender categories (youth and women) may be disadvantaged by lack of access to land to engage in tomato cultivation
Gender related opportunities	- Onyx F1 is a good variety to include in tomato growing enterprise since it does not elicit any demands biased to any gender class. - The variety can be easily grown by all gender categories engaged in tomato farming as a commercial enterprise
VMG issues and concerns in development, dissemination, adoption and scaling up	- Inclusivity of VMGs in tomato growing is critical to avoid perpetuation of marginalization - Lack of access to land and credit for tomato production
VMG related opportunities	- Tomato variety Onyx F1 has nutritious and 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
E: Case studies/profiles of success stories	

Success stories from previous similar projects	<p>-Contact farmers in Mwea who participated in the initial demonstration trials of the original Onyx variety adopted the variety and upgraded livelihood was evident as impact</p> <p>-Farmer's sons (youth) adopted tomato growing in land allocated to them prompted by the demonstrations of this variety among others in parent's farm</p> <p>-Impact studies conducted after the end of USAID-MIAC/SO7/ADSP projects indicated that 70% of tomato seed sales in project pilot areas were of the new varieties promoted, Onyx being one of the main ones</p> <p>-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 open field under irrigation.</p>
Application guidelines for users	Tomato cultivation manual and brochure with descriptor of this variety documented
F: Status of TIMP (1. Ready for upscaling 2. Requires validation 3. Requires further research)	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO- Agnes Ndegwa; Rebecca Faraay
Partner organizations	Royal Seed Co Ltd. Simlaws Seed Co. Ltd; MoALF&I

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

2.1.4 TIMP Name	Roma VF
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of superior tomato varieties adapted to local conditions with acceptable fruit characteristics specifically for processing
What is it? (TIMP description)	Roma VF is an improved open-pollinated determinate tomato variety suitable for open field cultivation and is very ideal for processing. It is determinate in growth habit, does not require staking and matures in 80-85 days with a yield potential of 83t/ha. Fruits are deep red in colour, pear-shaped and firm with few seeds, thick walls and dense flesh weighing 53g 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.
Justification	Roma VF is one of the very few varieties currently grown specifically for processing. It has preferable attributes such as determinate growth habit and fruits ripen over a concentrated period rather than continually. This ensures supply of adequate volumes to target processing markets. The variety produces fruits with characteristics demanded by the processing industry such as a higher ratio of flesh to pulp and is also the best variety for drying. The fruits are firm and can withstand transport to distant processing markets hence this would be an ideal variety for promotion in the target Counties. Roma VF is an improvement of the original Roma variety and requires adaptability testing in the target areas.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	- Farmers, extension service providers, County Government, Farmer groups/CBOs and NGOs, processors traders,
Approaches used in dissemination	- Stakeholder training, field demonstrations, farmer field schools, Radio/TV broadcasts, shows, trade fairs
Most effective approach	- Farmer participatory demonstrations and farmer field schools have been found effective in previous projects
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
C: Current situation and future scaling up	
Counties where already promoted if any	- The variety is grown in some tomato production areas such as the Coastal zone targeting processing market
Counties where TIMPS should be up-scaled	- Siaya, Elgeyo-Marakwet, Garissa, Mandera, West Pokot
Challenges in dissemination	- The variety has not been evaluated for tolerance to heat stress which is a constraint in the new target areas - It is not tolerant to emerging pests e.g. <i>Tuta absoluta</i>
Suggestions for addressing the challenges	- 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
Lessons learned	- Farmer participatory approach worked well in previous projects
Social, environmental, policy and market conditions necessary for development	- Organized marketing channels are critical for benefits to be derived from technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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 land to engage in tomato cultivation
Gender related opportunities	- All gender categories can participate in growing Roma VF tomato variety and can even be capacity built to venture into value addition at cottage industry level since the variety is suitable for processing
VMG issues and concerns in development, dissemination, adoption and scaling up	- There is room for inclusivity of VMGs in growing tomato such as variety Roma VF
VMG issues and concerns in adoption and scaling up	- Lack of access to land and credit for tomato production may hinder VMGs from taking up growing of the variety
VMG related opportunities	- The VMGs can easily grow the variety and further engage in cottage level processing to various products that have longer shelf life - 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

	- 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
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	- Tomato cultivation manual and brochures with descriptors of these varieties are documented
F: Status of TIMP (1. Ready for upscaling 2. Requires validation 3. Requires further research	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO: Agnes Ndegwa, Rebecca Faraay, Rahab Magoti, Charity Gathambiri, Finyange Pole,
Partner organizations	Royal Seed Co Ltd. Simlaws Seed Co. Ltd; MoALF&I

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

2.1.5 TIMP Name	Kilele F1
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of superior tomato varieties adapted to local conditions with acceptable fruit characteristics
What is it? (TIMP description)	Kilele F1 is an improved hybrid tomato variety with the following characteristics: <ul style="list-style-type: none"> • Medium determinate growth habit • Very firm elongated-oval fruits • Long harvest period upto 10 weeks • Long shelf life upto 21 days • Resistant to Tomato yellow leaf curl virus (TYLCV), Tomato Mosaic virus (TMV), Verticillium wilt, Fusarium wilt and nematodes
Justification	The variety has attributes that make it suitable for cultivation in open field cultivation such as determinate growth habit thus does not require staking, firm fruit with long shelf life and good transportability as well as resistance to some of the major tomato diseases. Improved hybrid varieties like Kilele F1 with acceptable

	attributes require validation for adaptability in emerging tomato production frontiers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, processors
Approaches used in dissemination	Stakeholder training, field demonstrations, farmer field schools, Radio/TV broadcasts, 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 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
C: Current situation and future scaling up	
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	- Siaya, Elgeyo- Marakwet, Garissa, Mandera,
Challenges in dissemination	- The variety has not been evaluated for tolerance to heat stress which is a constraint in the new target areas - Not tolerant to emerging pests e.g. <i>Tuta absoluta</i>
Suggestions for addressing the challenges	- There is need to include the variety in the evaluation of existing/introduced varieties for heat stress tolerance and acceptable characteristics in target areas
Lessons learned	- Farmer participatory approach has been found effective in previous related research activities
Social, environmental, policy and market conditions necessary for development and upscaling	- Organized marketing channels critical for benefits to be derived from technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 155,000/ha (Total variable costs)
Estimated returns	KES 750,000/ha gross margin
Gender issues and concerns in development, dissemination, adoption and scaling up	- Some gender categories (youth and women) may be disadvantaged by lack of access to land to engage in tomato cultivation - Seed cost of hybrid varieties is relatively higher and this could be Hybrid
Gender related opportunities	- The variety integrates well in tomato commercial enterprise across the gender divide if the issues of concern are well addressed
VMG issues and concerns in	- Lack of access to land and credit for tomato production may hinder VMGs from growing this variety

development, dissemination, adoption and scaling up	
VMG related opportunities	<ul style="list-style-type: none"> - Tomato variety Kilele F1 has nutritious and 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
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Tomato cultivation brochure with descriptor of this variety is documented
F: Status of TIMP (1. Ready for upscaling 2. Requires validation 3. Requires further research)	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO, Agnes Ndegwa; Rebecca Faraay, Rahab Magoti, Charity Gathambiri
Partner organizations	Sygenta Seed Co Ltd. Simlaws Seed Co. Ltd; MoALF&I

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

2.1.6 TIMP Name	Anna F1
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of information on superior tomato varieties suitable for greenhouse cultivation with acceptable fruit characteristics
Justification	Anna F1 is an indeterminate tomato variety that produces fruits for a prolonged period without topping-off and is therefore very ideal for greenhouse cultivation. It has a long harvest duration of up to 8 months and a very high yield potential of up to 300 tons/ha. This implies that a farmer can have continuous production of tomato with adequate volumes to sustain an established market for almost one year. This variety is suitable for deals to supply supermarkets and other large retail markets. The variety is tolerant to some of the tomato diseases constraining production and this is an advantage to the farmer in terms of reduced costs on control measures. The fruit have preferred characteristics such as deep red colour and good

	firmness to withstand transportation even to distant markets. The variety should be included in validation trials for greenhouse production in suitable target areas.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Processors
Approaches used in dissemination	Stakeholder training, Farmer Participatory demonstrations, farmer field schools, radio/TV broadcasts
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 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
C: Current situation and future scaling up	
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	- Future scaling up: Siaya, Elgeyo- Marakwet, Garissa, Mandera, West Pokot (if demanded)
Challenges in dissemination	- In-appropriate greenhouse structures - The variety is not tolerant to emerging pests e.g. <i>Tuta absoluta</i> and problematic diseases such as bacterial wilt - Telephone-farming is rampant with many greenhouse farmers
Suggestions for addressing the challenges	- Appropriate greenhouse structures should be promoted to ensure that the optimum potential of recommended varieties for the cultivation system is achieved - Varieties with tolerance to the biotic and abiotic stresses need to be introduced and evaluated - The person actually managing the greenhouse should be the recipient of training on greenhouse farming
Lessons learned	- Experiences gained while working with greenhouse tomato farmers indicate that: - Farmer participatory approach works where farmers practically gain hands-on experience in managing greenhouse crop - 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	- Organized marketing channels are critical for benefits to be derived from technology - Greenhouse crop cultivation requires appropriate regulatory frameworks

development and up-scaling	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 400,000 (including cost of 8x30 greenhouse)
Estimated returns	KES 720,000 (1st season)
Gender issues and concerns in development dissemination, adoption and scaling up	<ul style="list-style-type: none"> - 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 - 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	<ul style="list-style-type: none"> - All gender categories can participate in growing tomato varieties in greenhouse - A lucrative commercial enterprise across the gender divide and for VMGs - It should be attractive especially to youth since it is smart farming
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> - Lack of access to credit for initial capital cost of putting up greenhouse is a concern for VMGs
VMG related opportunities	<ul style="list-style-type: none"> - It is a lucrative enterprise and if involved, VMGs will be availed opportunity to be gainfully engaged
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> - Youth groups in Kiambu County and farmers in peri-urban Nairobi County are successfully growing this variety in greenhouses
Application guidelines for users	<ul style="list-style-type: none"> - Brochure and fact sheet with descriptor of this variety are documented
F: Status of TIMP (1. Ready for upscaling 2. Requires validation 3. Requires further research)	2. Requires validation
F: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO, Agnes Ndegwa, Vincent Ochieng, Rahab Magoti, Finyange Pole
Partner organizations	JKUAT, Royal Seed Co Ltd, Simlaws Seed Co. Ltd MoALF&I

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

2.1.7 TIMP Name	Tylka F1
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of information on superior tomato varieties suitable for greenhouse cultivation with acceptable fruit characteristics
What is it? (TIMP description)	<p>Tylka F1 is a hybrid tomato variety that is ideal for greenhouse cultivation but can also be grown in open field. It has the following characteristics:</p> <ul style="list-style-type: none"> • Indeterminate growth habit • Does not require staking • Vigorous open plant type with minimum foliage • Fruits are elongated oval, very firm with sweet flavor • Maturity: 75 days after transplanting • Harvest duration: 4-6 months • Fruit weight: 100-130g • High yield potential: 120t/240m² (8x30m greenhouse) • Long shelf life: up to 28 days • Resistant to Tomato leaf curl virus, Tomato mosaic virus and Grey spot
Justification	The variety is ideal for greenhouse cultivation and has a high yield potential and a long harvest duration. Farmers growing this variety have the assurance of continuous production in adequate volumes for the target market. The fruits have a tough skin that remains firm for a much longer period than in other varieties hence the variety can withstand harsh environments and transportation from distant markets and still retain postharvest quality. Tylka F1 is resistant to problematic viral and fungal diseases of tomato which is an advantage to the grower since resources for control measures are saved. The variety should be included in the validation of varieties for greenhouse cultivation in target areas where the technology is demanded.
Region promoted	Kirinyaga (Mwea, Kagio), Kiambu Kajiado, Muranga, Nairobi, Trans Nzoia, Uasin Gishu, Kisumu
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension service, Traders, Processors
Approaches used in dissemination	Stakeholder training, Farmer Participatory demonstrations, farmer field schools, radio/TV broadcasts
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 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
C: Current situation and future scaling up	
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	- In-appropriate greenhouse structures - Lack of access to credit for initial capital cost of putting up greenhouse is a concern - The variety is not tolerant to emerging pests e.g. <i>Tuta absoluta</i> and problematic diseases such as bacterial wilt
Suggestions for addressing the challenges	- Appropriate greenhouse structures should be promoted to ensure that the optimum potential of recommended varieties for the cultivation system is achieved - Varieties with tolerance to the biotic and abiotic stresses need to be introduced and evaluated - The person actually managing the greenhouse should be the recipient of training on greenhouse farming
Lessons learned	- Previous experience indicates that 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 would be more feasible
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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	- 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 - Lack of capital to set up greenhouse structure could be a concern - Some gender categories (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 the tomato variety in greenhouse

	- Growing the tomato variety in greenhouse should be especially attractive to youth since it is smart farming with quick gains
VMG issues and concerns in development, dissemination, adoption and scaling up	- Lack of access to credit for initial capital cost of putting up greenhouse is a concern
VMG related opportunities	- VMGs can easily undertake growing of the tomato variety in greenhouse if their concerns are addressed through affirmative action - It is a lucrative enterprise and if involved, VMGs will be availed opportunity to be gainfully engaged
E: Case studies/profiles of success stories	
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	- Brochure and fact sheet with descriptor of this variety documented
F: Status of TIMP 1.Ready for upscaling 2.Requires validation 3.Requires further research	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO: Agnes Ndegwa, Rahab Magoti, Finyange Pole, Charity Gathambiri, Vincent Ochieng
Partner organizations	JKUAT, Royal Seed Co Ltd, Simlaws Seed Co. Ltd MoALF&I

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

2.1.8 TIMP Name	Chonto F1
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of information on superior tomato varieties suitable for greenhouse cultivation with acceptable fruit characteristics
What is it? (TIMP description)	Chonto F1 is a hybrid premium tomato variety suited to greenhouse cultivation with the following characteristics: <ul style="list-style-type: none"> • Indeterminate growth habit • Good calyx retention, • Maturity to first harvest: 75 days

	<ul style="list-style-type: none"> • Long harvest period of up to 8 months • Fruit weight: 150-200g • Yield: 28-36 t/240 m² (8x30m greenhouse) • Long shelf life up to 21 days
Justification	
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Processors
Approaches used in dissemination	Stakeholder training, Farmer Participatory demonstrations, farmer field schools, radio/TV broadcasts
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 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
C: Current situation and future scaling up	
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	Future scaling up: Siaya, Elgeyo- Marakwet, Garissa, Mandera(if demanded)
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 learned	-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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 400,000 (including cost of 8x30m greenhouse)
Estimated returns	KES 750,000 (1st season)
Gender issues and concerns in development,	- 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

dissemination, adoption and scaling up	
Gender related opportunities	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - It is a lucrative enterprise and if involved, VMGs will be availed opportunity to be gainfully engaged
E: Case studies/profiles of success stories	
Success stories	-Youth groups in Kiambu and farmers in peri-urban Nairobi County are successfully growing this variety in greenhouse
Application guidelines for users	Brochure and fact sheet with descriptor of this variety are documented
F: Status of TIMP 1.Ready for upscaling 2.Requires validation 3.Requires further research	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO: Agnes Ndegwa, Rahab Magoti, Finyange Pole, Charity Gathambiri, Vincent Ochieng
Partner organizations	JKUAT, Royal Seed Co Ltd, Simlaws Seed Co. Ltd MoALF&I

2.1.9 TIMP Name	Bravo F1
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of information on superior tomato varieties suitable for greenhouse cultivation with acceptable fruit characteristics
What is it? (TIMP description)	<p>Bravo F1 is hybrid tomato variety that adapts well to a wide range of agro-ecological zones. It has the following attributes:</p> <ul style="list-style-type: none"> • Indeterminate growth habit • Long harvest period • Maturity: 75 days from transplanting • Fruit weight: 120-150g • Yield: 24-31 t/240 m² • Long shelf life of up to 21 days at room temperature

	<ul style="list-style-type: none"> Resistant/ tolerant to tomato Yellow Leaf Curl Virus (TYLCV), Fusarium Wilt, Verticillium Wilt, Grey Leaf Spot and Nematode
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: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Processors
Approaches used in dissemination	Stakeholder training, Farmer Participatory demonstrations, farmer field schools, radio/TV broadcasts
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	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
C: Current situation and future scaling up	
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(if demanded)
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 learned	- Previous experience has shown that 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 critical for benefits to be derived from technology -Greenhouse crop cultivation requires appropriate regulatory frameworks

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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
E: Case studies/profiles of success stories	
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	Brochure and fact sheet with descriptor of this variety are documented
F: Status of TIMP 1.Ready for upscaling 2.Requires validation 3.Requires further research	2. Requires validation
F: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO/JKUAT: Agnes Ndegwa, John Wesonga, Rahab Magoti, Finyange Pole, Charity Gathambiri, Vincent Ochieng
Partner organizations	Royal Seed Co Ltd, Simlaws Seed Co. Ltd MoALF&I

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

2.1.10 TIMP Name	Mavuno F1
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of information on superior tomato varieties suitable for greenhouse cultivation with acceptable fruit characteristics
What is it? (TIMP description)	Mavuno F1 is a hybrid tomato variety that is ideal for greenhouse cultivation and has the following characteristics: <ul style="list-style-type: none"> • Indeterminate growth habit • Maturity: 70 days after transplanting • Continuous fruit set • Long harvest duration: up to 12 months • Fruit weight: 100-130g • Yield Potential: 24-26t/240m² greenhouse • Long shelf life (up-to 21 days) • Tolerant to bacterial and Fusarium wilt, Tomato Mosaic Virus, Blossom end rot and nematodes
Justification	The variety is very ideal for greenhouse cultivation since it has a very long harvest duration up to one year and is high yielding. Fruits have acceptable characteristics preferred in the market. It is tolerant to some of the problematic diseases, nematodes and blossom end rot physiological disorder which can be a big constraint in hot dry areas where most of the target counties are located. Therefore, this variety is a good choice for adaptability trials in these areas.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Processors
Approaches used in dissemination	Stakeholder training, Farmer Participatory demonstrations, farmer field schools, radio/TV broadcasts
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	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
C: Current situation and future scaling up	
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	Future scaling up: Siaya, Elgeyo- Marakwet, Garissa, Mandera(if demanded)

Challenges in dissemination	-Inappropriate greenhouse structures -The variety is not tolerant to emerging pests e.g. <i>Tuta absoluta</i> and problematic diseases such as bacterial wilt
Suggestions for addressing the challenges	-There is need need to introduce and evaluate heat stress and bacterial wilt tolerant varieties with acceptable characteristics for evaluation in target areas
Lessons learned	-Past experience indicates that 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 critical for benefits to be derived from technology -Greenhouse crop cultivation requires appropriate regulatory frameworks
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 400,000 (including cost of greenhouse)
Estimated returns	KES 700,000/ha (1st season)
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 land and capital to put up a greenhouse
Gender related opportunities	- 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 - All gender categories can participate in growing tomato varieties in greenhouse
VMG issues and concerns in development and dissemination	- 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
E: Case studies/profiles of success stories	
Success stories	-Youth groups in Kiambu and farmers in peri-urban Nairobi County are successfully growing this variety in greenhouse
Application guidelines for users	Brochure and fact sheet with descriptor of this variety are documented
F: Status of TIMP 1.Ready for upscaling 2.Requires validation 3.Requires further research	2. Requires validation
F: Contacts	
Contacts	Institute Director, KALRO Kandara

Lead organization and scientists	KALRO/JKUAT: Agnes Ndegwa, John Wesonga, Rahab Magoti, Finyange Pole, Charity Gathambiri, Vincent Ochieng
Partner organizations	Royal Seed Co Ltd, Simlaws Seed Co. Ltd MoALF&I

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

2.1.11 TIMP name	Introduced Cherry tomato variety (Koko)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
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. High level of youth unemployment hence the need to provide avenues for entrepreneurship for the youth.
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 and has the following features: <ul style="list-style-type: none"> • 75 days to maturity (start of harvesting), • Indeterminate with long harvesting period up to 3 years possible • Round, red, sweet, flavored fruit • Adapted to varying climates. • Disease resistant • Yield: 2.5kg of fruit/plant per year (1.15ton/240m² greenhouse) • Harvested 3 days per week
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: Assessment of dissemination and scaling up/out approaches	
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 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
C: Current situation and future scaling up	
Current extent of reach	Limited
Counties where already promoted, if any	Kiambu, Nyeri, Nakuru
Counties where TIMP will be up-scaled	Kiambu, Nyeri, Nakuru, Kajiado
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 learned in up-scaling, if any	Cherry tomatoes are highly productive and are acceptable to the Kenyan Market
Social, environmental, policy and market conditions necessary for development and up-saling	Approval by KEPHIS
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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"> - 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 - It is a lucrative enterprise and if involved VMGs will be availed opportunity to be gainfully engaged
E: Case studies/profiles of success stories	

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	Cherry Tomato cultivation manual and brochures with descriptors of these varieties are documented
F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research)	2. Requires validation
G: Contacts	
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

2.1.12 TIMP name	Introduced cherry tomato variety (Chika)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
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"> • 75 days to maturity (start of harvesting), • Indeterminate with long harvesting period up to 3 years possible • Round, red, sweet, flavored fruit • Adapted to varying climates. • Disease resistant. • Yield: 2.5 kg/ plant per year (1.15ton /240m² greenhouse) • Harvested 3 days per week
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: Assessment of dissemination and scaling up/out approaches	
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 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
C: Current situation and future scaling up	
Current extent of reach	Limited
Counties where already promoted, if any	Kiambu, Nyeri, Nakuru
Counties where TIMP will be upscaled	Kiambu, Nyeri, Nakuru, Kajiado
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 663,840.00 /240m ² (variable costs)
Estimated returns	KES 1,352,160/240m ² 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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
E: Case studies/profiles of success stories	
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	Tomato cultivation manual and brochures with descriptors of these varieties are documented
F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research)	2. Requires validation
G: Contacts	
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

2.2 Agronomic practices

2.2.1 TIMP Name	Raising clean Tomato seedlings in Nursery beds
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of clean tomato seedlings
What is it? (TIMP description)	The management practice entails the step by step process of nursery site selection, preparation of beds, solarization, sowing of the seeds and management of the nursery upto the time the seedlings are ready for transplanting. Nursery beds should be of 1m width and convenient length.
Justification	Clean planting material is a pre-requisite for successful tomato production. However, use of poor quality seedlings obtained from non-reputable sources is rampant. Some farmers also use “own seed” “ <i>Kukamua mbegu</i> ” which is a wrong practice that

	should be discouraged. Tomato farmers require sensitization on importance of raising clean seedlings properly on-farm using certified seed of preferred varieties.
B: Assessment of dissemination and scaling up /out approaches	
Users of TIMP	Farmers, commercial vegetable nursery operators
Approaches used in dissemination	Farmer trainings, 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 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
C: Current situation and future scaling up	
Counties where already promoted	Kirinyaga, Machakos, Kitui, Meru, Busia
Counties where TIMPS should be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	-Lack of adherence to recommendations even after capacity building in areas where promoted
Suggestions for addressing the challenge	-Continuous capacity building and practical demonstrations -Emphasis on the dangers of using poor quality seedlings
Lessons learned in up-scaling if any	- Farmer participatory approach and continuous capacity building is necessary
Social, environmental, policy and market conditions necessary for up scaling	All gender categories can participate in greenhouse tomato nursery management which has potential to be undertaken as a business and is a good opportunity for youth and women groups
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 20,000 (12m ² Nursery)
Estimated returns	KES 5 per seedling
Gender issues and concerns in development, dissemination, adoption and up scaling	None
Gender related opportunities	All gender categories can participate in tomato nursery management which has potential to be undertaken as a business
VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	Tomato nursery requires small space, is not labour intensive and can be easily undertaken by VMGs for income generation
E: Case studies/profiles of success stories	
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
F. Status of TIMPS readiness 1) Ready for up scaling; 2) Requires validation; 3) Requires further research	(1) Ready for up-scaling
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO, Agnes Ndegwa; Rebecca Faraay, Rahab Magoti, Charity Gathambiri
Partner organizations	MoALF&I

Gap

1. Demonstration of management practices in new target areas required

2.2.2 Technology name	Recommended Spacing in open field
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem addressed	Inappropriate spacing methods used by farmers
What is it? (TIMP description)	-The recommended spacing of tomato in 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 growing cycle, seasonal changes in the light, climate and training and pruning of the crop There is need for demonstration and capacity building on the right spacing of tomatoes for rain fed cultivation to achieve high yields.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension Service providers
Approaches 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 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
C: Current situation and future scaling up	
Counties where already promoted	Major tomato growing Counties: Kirinyaga, Kajiado
Counties where TIMPS should be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	Farmers may modify the recommendation due to associated practices e.g. irrigation mode
Suggestions for addressing the challenge	Reviewing/adjusting recommendation but still optimizing plant population
Social, environmental, policy and market conditions necessary	Organized marketing critical for benefits of the recommendation to be derived
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	Technology easily practical for all gender categories
Gender related opportunities	All gender categories can participate in tomato transplanting
VMG issues and concerns in development, dissemination, adoption and scaling up	- Activity may be difficult for the physically challenged, elderly, and ailing members of target communities
VMG related opportunities	-VMGs who are active and physically able can be gainfully engaged in tomato transplanting
E: Case studies/profiles of success stories	
Success stories	-Farmers in major tomato growing areas were sensitized on proper spacing recommendation in previous initiatives such as the MIAC and ADSP projects
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guide on recommended tomato spacing are documented
F: Status of TIMPS readiness: 1) Ready for up-scaling; 2) Requires validation; 3) Requires further research	2) Requires validation
F: Contacts	

Contacts	
Lead organization and scientists	KALRO, Agnes Ndegwa, Rahab Magoti, Rebecca Faraay
Partner organizations	MoALF&I

Gap

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

2.2.3TIMP NAME	Nutrition management
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem addressed	Farmers lack knowledge on appropriate nutrient management in tomato cultivation
What is it? (TIMP description)	The management practice details the importance and process of soil sampling and testing as a prerequisite to determining the nutritional status of the soil at specific farm sites. Guided by these results, specific nutrient requirements are derived to augment the general recommendation as follows: - Application of well decomposed manure at transplanting at the rate of two handfuls per planting hole (20t/ha) and mix thoroughly with the soil -Apply 10g or one teaspoonful (200 kg/ha)TSP fertilizer- per planting hole and mix well with soil - Top dress with CAN at 100 kg/ha (5g or ½ teaspoonful per plant), when plants are 20-25 cm high and 200 kg/ha (10g or one teaspoonful per plant) after 3-4 weeks -Apply foliar feed (fruit and flower) weekly from onset of flowering
Justification	Inadequate knowledge in nutrient management in tomato cultivation such as appropriate fertilizer/manure type, timing, method and levels of application leads to low yields. Farmers require capacity building on nutrient management to improve tomato yields, fruit quality and to reduce production costs through efficient use of nutrients.
Users of TIMP	Farmers
Approaches 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	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
C: Current situation and future scaling up	
Counties where TIMP where already promoted if any	Major tomato growing Counties: Kirinyaga, Kajiado
Counties where TIMP will be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	Lack of access to required inputs
Suggestions for addressing the challenges	Adequate timing, amount, and placement of fertilizers and manures can reduce negative effects of excessive fertilization, reduces soil salinity and nutrient leaching.
Lessons learnt in up-scaling if any	Previous initiatives indicated that farmer participatory approach in technology dissemination works well
Social, environmental, policy and market conditions necessary	-Access to inputs (fertilizers, manure)
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 155,000/ha
Estimated returns	KES 750,000/ha
Gender issues and concerns in development, dissemination, adoption and scaling up	-Some gender categories (women) may be disadvantaged in accessing the information due to lower participation in capacity building for a -Some gender categories (women and youth) may lack access to resources to procure required inputs
Gender related opportunities	- All gender categories can participate in nutrient management which has potential to increase tomato yields.
VMG issues and concerns in development, dissemination, adoption and scaling up	- Some VMGs may lack access to resources to procure required inputs - Some VMGs (elderly, ailing, physically challenged) may find the operation of manure/fertilizer application cumbersome
VMG related opportunities	- If concerns are addressed, VMGs can apply the recommendations on nutrient management to engage in the potentially lucrative tomato growing venture
E: Case studies/profiles of success stories	
Success stories	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 fertilization for higher yields.
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guide on tomato nutrition management are documented
F: Status of TIMPS readiness: 1) Ready for up-scaling 2) Requires validation 3) Requires further research	1) Ready for up-scaling
G: Contacts	

Contacts	Institute Director HRI; Centre Director- KALRO Kandara
Lead organization and scientists	KALRO, Agnes Ndegwa Rahab Magoti, Rebecca Faraay
Partner organizations	MoALF&I, Agro-dealers

Gap

3. Demonstration of management practices in new target areas required

2.2.4.TIMP Name	Drip irrigation
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem addressed	Water stress in open field tomato cultivation
What is it? (TIMP description)	The management practice details the drip irrigation mode for tomato crop. Drip laterals should be placed at the center of the planting bed/row. Inline 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.
Justification	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, and water harvesting methods. Various drip systems require validation for their efficiency in target areas for increased tomato yields.
B: Assessment of dissemination and scaling up /out approaches	
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	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
C: Current situation and future scaling up	
Counties where already promoted	Major tomato growing counties such as Kirinyaga and Kajiado
Counties where TIMPS should be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	Not adopted by all sensitized farmers
Suggestions for addressing the challenge	Sensitization should include practical demonstrations of the benefits of the management practice
Lessons learned in upscaling if any	Demonstrations and Farmer participatory approach are key to adoption of recommendations
Social, environmental, policy and market conditions necessary for upscaling	Drip irrigation kits should be subsidized in cost so that they can be affordable for ordinary farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES
Estimated returns	KES
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
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Some farmers in other pilot project areas are successfully practicing drip irrigation in tomato cultivation
Application guidelines for users	Fliers on drip irrigation kits appropriate for Tomato cultivation in open field, manual, brochure and fact sheet with detailed guide on water use efficiency in tomato are documented
F. Status of TIMPS readiness 1) Ready for up scaling; 2) Requires	2) Ready for up scaling;

validation; 3) Requires further research	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO Isiah Sijali, Rahab Magoti Agnes Ndegwa Rebecca Faraay
Partner organizations	MoALF&I, Agro-preneurs

Gap

1. Demonstration of the technology in target areas

2.2.5 TIMP Name	Staking and Pruning in open field
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of information and skills on tomato plant management
What is it? (TIMP description)	<p>Pruning should start 20 to 30 days after transplanting at weekly intervals retaining two stems per plant. The main stem of tomato plant branches into two after the first flower cluster. Those two branches are retained and all others branches are removed. All the branches developing at the base of the stem should also be removed. 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.</p> <p>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</p>
Justification	Inappropriate pruning and staking of tomatoes, leads to low yields, quality and prices offered at the farm gate. 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. Staking 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: Assessment of dissemination and scaling up /out approaches	
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	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
C: Current situation and future scaling up	
Counties where already promoted	Not done
Counties where TIMPS should be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	Not done
Suggestions for addressing the challenge	Technology can be practiced by all gender categories
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for upscaling	Staking materials should be readily available without any threat to the environment by integrating crop and agroforestry
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	- The management practice might have an element of drudgery for some gender categories (women) since it requires physical exertion to put stakes in place
Gender related opportunities	- All gender categories can participate in staking and pruning of tomatoes.
VMG issues and concerns in development, dissemination, adoption and scaling up	- 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
VMG related opportunities	
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 detailed guide on staking and pruning are documented
F. Status of TIMPS readiness 1) Ready for up scaling; 2) Requires validation; 3) Requires further research	2) Ready for up scaling
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO- Agnes Ndegwa, Rahab Magoti Rebecca Faraay,
Partner organizations	MoALF&I

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

2.2.6. TIMP Name	Bio-degradable Mulching materials for weed management and moisture retention
Category (i.e. technology, innovation or management practice)	Technology
A:Description of the technology, innovation or management practice	
Problem addressed	Weeds and moisture stress
What is it? (TIMP description)	Mulching is a soil surface management practice that reduce water loss though 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	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.
B: Assessment of dissemination and scaling up /out approaches	
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	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

C: Current situation and future scaling up	
Counties where already promoted	Kirinyaga and Kajiado Counties
Counties where TIMPS should be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	Some mulching materials such as bio-degradable poethylene may not be readily available to farmers
Suggestions for addressing the challenge	Improve access of mulching materials at local levels
Lessons learned in upscaling if any	Practical demonstrations enhance adoption of recommended practices
Social, environmental, policy and market conditions necessary for upscaling	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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
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	-
E: Case studies/profiles of success stories	
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
F. Status of TIMPS readiness 1) Ready for up scaling; 2) Requires validation; 3) Requires further research	2) Requires validation;
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO Agnes Ndegwa Rahab Magoti, Charity Gathambitri, Finyage Pole
Partner organizations	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

2.2.7 TIMP name	Improved greenhouses for production of high quality tomatoes
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	The current greenhouses for small scale farmers do not provide the right conditions for production of tomatoes. This has led to abandonment of many greenhouse around the country. At the same time a negative attitude emerges towards greenhouse farming.
What is it? (TIMP description)	The improved greenhouses has the following features: <ul style="list-style-type: none"> • It measures 17m x 6m • The ground is covered with a woven mat • The top is covered in plastic cladding material, has a top vent and covered with a shade net • The sides are covered with insect proof net with a roller up system made of plastic cladding materials • It has double door entrance porch system to assist in containment of pests • It is equipped with a timed irrigation system that supplies water or nutrient solution at planned intervals for 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	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 better condition for higher productivity and better quality and requires validation in target areas.
Region promoted	None
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Growers of high value horticultural crops, service providers involved in greenhouse construction
Approaches to be used in dissemination	Newspapers and magazines, ASK shows, Trade fairs, 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 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
C: Current situation and future scaling up	
Counties where already promoted, if any	Kiambu, Naivasha and Nyeri
Counties where TIMP will be upscaled	Kiambu, Kajiado,
Challenges in dissemination	Limited local competence in the construction of suitable greenhouses
Suggestions for addressing the challenges	Capacity building and co-development of the new greenhouses
Lessons learned in upscaling, if any	None
Social, environmental, policy and market conditions necessary for development and upsaling	Materials for the greenhouses are not readily available since they are imported and should be availed locally at subsidized cost
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	Technology is relevant to either gender without any issue likely
Gender related opportunities	The greenhouse enables high productivity and quality hence can be a good avenue for empowering women. The greenhouse has an improved working environment conducive for women working.
VMG issues and concerns in development, dissemination, adoption and scaling up	High initial capital requirement may a barrier for adoption by VMG.
VMG related opportunities	The greenhouse enables high productivity and quality hence can be a good avenue for empowering VMGs
E: Case studies/profiles of success stories	
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 (1. Ready for upsaling; 2. Requires validation; 3. Requires further research	2. Requires validation

G: Contacts	
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

2.2.8 TIMP name	Improved technique for raising high quality clean tomato Seedlings in greenhouse
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Lack of clean planting material
What is it? (TIMP description)	Structure and process of raising clean tomato seedlings in 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 based. 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 introduction of pests and pathogens into the seedlings.
Justification	Clean planting material is a pre-requisite for successful tomato production. Use of poor quality seedlings obtained from non-reputable sources. Raising seedlings in greenhouse in containers is more efficient for space (can be placed on shelves) Seed germination percentage is higher (80-90%) compared to 70% in conventional nursery beds in the field Seedlings have big root mass, plants are stronger so low incidence of transplants drying. The system can enable faster establishment of crops to optimize use of limited water occasioned by climate change.

Region promoted	Kajiado (Plant raisers-Isinya), Kiambu, Naivasha (Longonot nurseries)
B: Assessment of dissemination and scaling up/out approaches	
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	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, Student interns, African Farmers Club to spur youth start-up ventures.
C: Current situation and future scaling up	
Counties where already promoted, if any	Kajiado, Nakuru- Adopted by some individual farmers and some agropreneurs as a business but requires up-scaling
Counties where TIMP will be upscaled	Future scaling up: Kajiado, Kisumu, Siaya, Elgeyo-Marakwet, Garissa, Mandera,
Challenges in dissemination	-Capital cost in setting up greenhouse/shade-house structure may be prohibitive for many farmers - Lack of access to credit for farmers
Suggestions for addressing the challenges	Organized marketing channels are critical for benefits to be derived from technology
Lessons learned in upscaling, if any	N/A
Social, environmental, policy and market conditions necessary for development and upsaling	Not done
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	
Estimated returns	
Gender issues and concerns in development, dissemination, adoption and scaling up	- All gender categories can participate in greenhouse tomato nursery management which has potential to be undertaken as a business - A good opportunity for youth and women groups
Gender related opportunities	- Seedling production is an intensive high revenue which can empower women. Only limited land is required.

VMG issues and concerns in development, dissemination, adoption and scaling up	VMG will need financial support to establish nursery business
VMG related opportunities	-Management of tomato nursery in greenhouse could be a good enterprise for commercialization by VMGs -Business can be conducted entirely on site where clients place orders and collect at site, not labour intensive -Seedling production is an intensive high revenue which can empower VMG
E: Case studies/profiles of success stories	
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). JKUAT and KALRO centres have very successful TC banana and other fruit trees nursery which has contributed immensely in the development of fruit industry and promotion of vegetable nursery can ride on this success
Application guidelines for users	Brochure and fact sheet with detailed guide on greenhouse-tomato nursery management are documented
F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research)	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO/JKUAT Rahab Magoti, John Wesonga, Agnes Ndegwa, Rebecca Faraay
Partner organizations	MoALF&I, 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

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

What is it? (TIMP description)	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.
Justification	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.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Growers of tomatoes and other horticultural crops, seedling propagators,
Approaches to be used in dissemination	Media including social media, Practical training, Demonstrations, farmers field schools
Most effective approach	Practical training, Demonstrations, farmers field schools
Critical/essential factors for successful promotion	Increase availability of cocopeat. Currently cocopeat is available in only few specialized shops and is imported
Partners/stakeholders for scaling up and their roles	County Government- to provide extension services and funding; Agro-dealers - to provide agro inputs including coopeat; 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
C: Current situation and future scaling up	
Counties where already promoted, if any	Kiambu- None by JKUAT but is widely used among large scale growers
Counties where TIMP will be upscaled	Kiambu, Kajiado,
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 learned in upscaling, if any	None
Social, environmental, policy and market conditions necessary for development and upsaling	Limited availability of cocopeat and high prices

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KSh 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	Initial capital may hinder adoption by some gender categories but with financial support they can be empowered
Gender related opportunities	<ul style="list-style-type: none"> - All gender categories can participate in utilizing the technology - Highly suitable for empowerment of women due to high returns. Limited land resources required. Less laborious.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> - Initial capital may hinder adoption by VMGs but with financial support they can be empowered
VMG related opportunities	<ul style="list-style-type: none"> - Highly suitable for empowerment of VMG due to high returns, limited land resources required and is not laborious
E: Case studies/profiles of success stories	
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 (1. Ready for upsaling; 2. Requires validation; 3. Requires further research)	2. Requires validation
G: Contacts	
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, 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

2.2.10 TIMP name	Styrofoam based intensive tomato production
Category (i.e. technology, innovation or management practice)	Technology

A: Description of the technology, innovation or management practice	
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 (cocopeat) in which tomatoes are grown. The Styrofoam boxes are available on the Kenyan market for packaging of fragile equipment during transportation. The boxes 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: Assessment of dissemination and scaling up/out approaches	
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
C: Current situation and future scaling up	
Counties where already promoted, if any	Kiambu-(JKUAT)

Counties where TIMP will be upscaled	Kiambu, Kajiado
Challenges in dissemination	None known
Suggestions for addressing the challenges	N/A
Lessons learned in upscaling, if any	N/A
Social, environmental, policy and market conditions necessary for development and upsaling	None
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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.
E: Case studies/profiles of success stories	
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.
F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research	2. Requires validation
G: Contacts	
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

2.2.11 TIMP name	Capillary wick based irrigation system
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
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"> • Capillary wick irrigation involves the use of a device that delivers water by capillary movement from a reservoir to the plant growing medium • 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. • The compartment has provision through which wick materials pass through from inside to a water reservoir. • 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 • Various growing substrates including soil, cocopeat and mixtures may be used • A capillary wick of a suitable material and dimensions runs from the substrate compartment to the water reservoir • The system is modular allowing starting small and expanding on need and capacity • Initial system costs KSh 10,000 per module with 32 plant capacity
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: Assessment of dissemination and scaling up/out approaches	
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
C: Current situation and future scaling up	
Counties where already promoted, if any	Limited
Counties where TIMP will be upscaled	Kiambu, Machakos
Challenges in dissemination	Kiambu, Nakuru, Laikipia, Kajiado
Suggestions for addressing the challenges	None
Lessons learned in upscaling, if any	N/A
Social, environmental, policy and market conditions necessary for development and upsaling	N/A
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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"> - VMGs are accommodated and can benefit if included in the dissemination and scaling up - It is relatively cheap and modular hence can address the issue of marginalized persons
E: Case studies/profiles of success stories	
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
F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research	2. Requires validation

G: Contacts	
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 https://www.rubencentre.org . (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 operators manual to support implementation

2.3 Physiological Disorders

2.3.1.TIMP Name	Management of blossom End Rot
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Physiological disorder 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. Affected fruits ripen more rapidly than normal reducing the marketable quality.
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 ₄ 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, but under good management practices the problem can be prevented. This is done by regular watering and calcium application to correct conditions that trigger the disorder. Affected fruits are harvested to reduce stress on the plant and to allow it to direct its energy to other tomatoes be corrected. This information should be imparted to farmers to improve tomato productivity.
B: Assessment of dissemination and scaling up /out approaches	
Users of TIMP	
Approaches used in dissemination	Farmer trainings, 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 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
C: Current situation and future scaling up	
Counties where already promoted	Kirinyaga, Embu, Meru, Kjiado, Tharaka Nithi, Busia, Makueni, Bungoma, Taita Taveta, Makueni, Tranzoia, Busia, Uasin Gishu, Machakos,
Counties where TIMPS should be up scaled	Elgeyo Marakwet, Garissa, Mandera, Siaya, West Pokot
Challenges in dissemination	None
Suggestions for addressing the challenge	N/A
Lessons learned in upscaling if any	Practical demonstrations aid in promoting adoption of management practices
Social, environmental, policy and market conditions necessary for upscaling	None
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development and dissemination	None
Gender related opportunities	All gender categories can participate in management of blossom end rot.
VMG issues and concerns in development and dissemination	-None
VMG related opportunities	- All VMGs can participate in management of blossom end rot
E: Case studies/profiles of success stories	
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
F. Status of TIMPS readiness 1) Ready for up scaling; 2) Requires validation; 3) Requires further research	2) 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

2.3.2.TIMP Name	Shade-net tomato cultivation for management of sunscald
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Heat stress which affects the quality of tomato fruit
What is it? (TIMP description)	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 colder areas while in hotter it should be 70-80%.
Justification	Use of shade net is a climate smart technology that ensures that tomato fruit remains free from scalding when temperatures are very high. 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.
B: Assessment of dissemination and scaling up /out approaches	
Users of TIMP	Farmers, Extension service providers, agro-prenuers operators
Approaches used in dissemination	Farmer trainings, 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 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
C: Current situation and future scaling up	

Counties where already promoted	Not done 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	Not done
Suggestions for addressing the challenge	
Lessons learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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"> - Technology practical for men, women, youth - Establishment of the shade net structure has cost implications that may be prohibitive for some gender categories
Gender related opportunities	All gender categories can practice technology
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> - Technology practical for VMGs - Establishment of the shade net structure has cost implications that may be prohibitive for some VMGs
VMG related opportunities	VMGs can practise technology if issues of concern are addressed
E: Case studies/profiles of success stories	
Success stories from previous similar projects	-
Application guidelines for users	Tomato cultivation manual, brochure and fact sheet with detailed guide on management of sun-scald in tomato are documented
F. Status of TIMPS readiness 1) Ready for up scaling; 2) Requires validation; 3) Requires further research	2) 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

2.4 Pests and Diseases

2.4.1 TIMP Name	Scouting for pests identification and control
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Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Limited awareness by farmers on the need to undertake scouting for pest attack in their fields
What is it? (TIMP description)	Scouting techniques and frequency to determine the presence of the different types of pests 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 as well as saving on the costs of pesticides.
B: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	

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 favour 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 _
Lessons learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 300 per day for 3 months
Estimated returns	KES 500,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	None
Gender related opportunities	All gender categories can participate in tomato field scouting 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 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
E: Case studies/profiles of success stories	
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
F: Contacts	
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&I, County governments, Universities (KU and JKUAT)
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2.4.2 TIMP Name	Integrated Pest Management control practices
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
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 post-harvest interval (PHI) that must be observed before the crop is harvested. This condition is hardly observed by farmers hence most of the produce reaching the consumers has high chemical residues which is a health hazard. Adoption of IPM practices for control of pests in the fields and greenhouses will not only reduce the costs for purchase of pesticides but will also make the final produce safe for consumption. The IPM strategy could either involve the use of a single control practice such as cultural control or a combination of two or more control practices. The use of chemicals is considered to be the last option.
B: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
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	-Capacity building and sensitization forums -Participatory approach in demonstrating the practice to farmers and economic analysis to convince them on cost effectiveness _
Lessons learned	Farmer participatory approach works
Social, environmental, policy and market conditions necessary	Organized collective marketing channels critical for benefits to be derived from practice
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 50,000 per acre
Estimated returns	KES 500, 000 per acre
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
E: Case studies/profiles of success stories	
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)	2, Requires validation
F: Contacts	
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&I, 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

2.4. 3 TIMP Name	Management of Soil pests (Cut worms, <i>Agrotis</i> spp and Chafer grubs, <i>Melolontha</i> spp) by use of integrated control practices
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	The major soil pests attacking tomato seedlings are cut worms, <i>Agrotis</i> spp and chafer grubs, <i>Melolontha</i> spp. 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.
What is it? (TIMP description)	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: 5% Malathion dust around the plant after transplanting preferably in the afternoon, 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 (Brigade, Sevin, Fastac or Karate).
Justification	Cutworms 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 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.
B: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 50,000 per acre
Estimated returns	KES 500, 000 per acre
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
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
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)	1. ready for up scaling
F: Contacts	
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&I, County governments, Universities (KU and JKUAT)

2.4.4 TIMP Name	Management of African bollworm, <i>Helicoverpa armigera</i> Hb by use of integrated control practices
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
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. 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.
B: Assessment of dissemination and scaling up/out approaches	
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.

C: Current situation and future scaling up	
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 30,000 per acre
Estimated returns	KES 200, 000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	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
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 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)	1. ready for up scaling
F: Contacts	
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&I, County governments, Universities (KU and JKUAT)
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2.4.6 TIMP Name	Management of Red spider mites, <i>Tetranychus spp.</i> by use of integrated control practices.
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	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.
What is it? (TIMP description)	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: Cultural practices . 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><i>Phytoseilus persimilis</i> has been very effective when used in the green house; Botanical pesticides. 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. Chemical control. 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 them as a result of the mites sucking out 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: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	

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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	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 Integrated cutworm 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
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 and practice Integrated red spider mite control
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)	1. ready for up scaling
F: Contacts	
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&I, County governments, Universities (KU and JKUAT)
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2.4.7 TIMP Name	Management of Tomato leaf miners (<i>Tuta absoluta</i> and <i>Liriomyza spp</i>) by use of integrated control practices
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Category (i.e. technology, innovation or management practice)	Management practice
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A: Description of the technology, innovation or management practice

Problem addressed	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.
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What is it? (TIMP description)	Integrated control practice for leaf miners involves the use of a combination of biological, natural enemies, 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> 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
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	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: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 70,000 per acre
Estimated returns	KES 500, 000 per acre
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 Integrated leafminer control once sensitized
VMG related opportunities	Integrated leaf miners control can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
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 have been sensitized on leafminer 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)	1. ready for up scaling
F: Contacts	
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&I, County governments, Universities (KU and JKUAT)

2.4.8 TIMP Name	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
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	

<p>Problem addressed</p>	<p>Thrips are small insects, about 1 to 2 mm long. They usually feed on the lower surface of leaves puncturing them and suck 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 high yield losses since they attack the growing tips and flowers leading to flower abortion. Their secretive habits (eggs are laid in plant tissue, the larvae and adult shelter in the flowers and</p>

	larvae pupate in the soil) makes them quite difficult to control using chemical control method. 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: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	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
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 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)	1. ready for up scaling
F: Contacts	
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&I, County governments, Universities (KU and JKUAT)

2.1.9 TIMP Name	Evaluation of pesticides for effectiveness in control of economic important pests for tomato
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	There is lack of information by farmers and agro-dealers on the efficacy of most agro-chemicals that are in the market today. Many agro-chemical companies have manufactured different types of pesticides for control of various 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 pests 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: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	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
E: Case studies/profiles of success stories	
Success stories	Efficacy trials have routinely been conducted by accredited institution such as KALRO in collaboration with PCPB
Application guidelines for users	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)	3. requires further research)
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, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&I, County governments, Universities

Research Gap

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

2.4.10 TIMP Name	Pesticides for management of insect pests
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	<ul style="list-style-type: none"> • High incidence of pests and disease • Inappropriate use of synthetic chemical pesticides •

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: Assessment of dissemination and scaling up/out approaches	
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"> • 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 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.

C: Current situation and future scaling up	
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"> • Lack of funds to purchase pesticides
Suggestions for addressing the challenges	<ul style="list-style-type: none"> -Provision of knowledge on appropriate use of pesticides -Training and demonstration on pesticide use -Economic analysis to convince growers on cost effectiveness
Lessons learned 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"> - Guidelines on residue limits for locally consumed tomato -Favorable climatic conditions for tomato production -Sustained market demand for high quality tomato fruits.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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"> - Application of pesticides may be cumbersome for some gender categories (women) - In some regions women and youth lack access and control over resources for production and benefits
Gender related opportunities	<ul style="list-style-type: none"> - Any gender can participate in tomato production using recommended crop health management practices for increased production and income generation
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> - Application of pesticides may be cumbersome for some gender categories (women) - Some VMGs lack access and control over resources for production and benefits
VMG related opportunities	<ul style="list-style-type: none"> - 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
E: Case studies/profiles of success stories	
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: STATUS OF TIMP READINESS (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation and further research
F: Contacts	
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&I, County governments, Universities: KU, JKUAT

Research Gaps

1. Evaluation of resistance to pesticides

2.1.11 TIMP Name	Safe use of pesticides
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Excessive pesticides application to crops, use of pesticides for spraying crops without wearing the right spraying gear, storage of pesticides in non-designated stores, spraying against the wind direction and use of pesticides without following the guidelines given in the labels.
What is it? (TIMP description)	Capacity building of farmers, crop protection teams and on safe handling and use of pesticides right from transportation from the agro-dealers to storage in their houses, mixing procedures and their application in the field in order to ensure safety of the crop, the person handling them and the environment at large.
Justification	Cases of improper use of pesticides are very common in most of the areas where 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. Most of these irregularities can easily be corrected through sensitization and capacity building forums so as the end users can be made aware of the best practices that should be used when handling pesticides.

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, 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.
C: Current situation and future scaling up	
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	None
Gender related opportunities	All gender categories can participate in the safe use of pesticides which has potential to increase yields of quality and safe tomatoes and reduce production costs
VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	Safe use of pesticides practice can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
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)	1. Ready for upscaling;
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, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&I, County governments, Universities

2.4.12 TIMP Name	Use of plant extracts for control of tomato pests
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
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. Plant extracts do not contain heavy metals and are safe to the environment. Once sprayed onto the tomato crop,

	harvesting can be done as early as the following day without having to observe the post-harvest interval.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	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.
C: Current situation and future scaling up	
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	None
Gender related opportunities	All gender categories can participate in the use of plant extracts technology which has potential to increase yields of quality and safe fruits and reduce production costs

VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	Use of plant extracts to control pests can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
E: Case studies/profiles of success stories	
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)	3. requires further research)
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, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&I, County governments, Universities

Gaps

1. Evaluation of efficacy of plant extracts for control of tomato pests

2.4.13 TIMP Name	Intercropping of tomatoes with garlic and onions to control pests
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
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: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	None
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	None

VMG related opportunities	The VMG can easily participate in the intercropping of tomato with garlic technology once sensitized
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
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)	3. requires further research)
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, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&I, County governments, Universities

Research Gaps

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

2.14 TIMP Name	Soil Solarization
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
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 polythene sheet 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: Assessment of dissemination and scaling up/out approaches	
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 farmer mobilization to lobby for changes in agriculture policies to favour the farmer.
C: Current situation and future scaling up	
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 learned 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	The technology can easily be adopted by all gender categories
Gender related opportunities	All gender categories can participate in the solarization technology which has potential to increase yields, quality and safety of tomatoes and reduce production costs
VMG issues and concerns in development, dissemination, adoption and scaling up	The VMGs can easily participate in the solarization technology once sensitized
VMG related opportunities	Solarization can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
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 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;
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, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&I, County governments, Universities

2.4.15 TIMP Name	Management of Early blight (<i>Alternaria solani</i>) by use of milk
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	Tomato early blight is a disease of economic importance in tomato production.
What is it? (TIMP description)	The innovation entails use of use of fresh milk as an IPM option for management of tomato early blight. This is done by mixing one litre of fresh milk in 9 litres of water to make a total 10 litres. The mixture is then used to spray the tomato crop against early blight.
Justification	Tomato early blight that is caused by <i>Alternaria solani</i> is one of the major diseases of economic importance. Farmers spend a lot of resources in trying to control the disease. the use of milk for control of early blight will go a long way in reducing costs, safeguarding the environment and also makes the produce safe to use at all times. Again milk is a product that is readily available at all times throughout the year and is also locally available making it easily accessible to the farmer.
B: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
Counties where technology is already promoted if any	Taita-Taveta. Adopted by a few farmers but a majority of them are yet to adopt the practice.
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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 50,000 per acre
Estimated returns	KES 500, 000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	-The innovation can easily be practiced by all gender categories -The use of milk may as a crop spray may present a scenario of making a choice between and nutrition especially for young babies in cases where milk is not available in plenty
Gender related opportunities	The innovation has potential to increase yields of quality and safe tomatoes and reduce production costs
VMG issues and concerns in development, dissemination, adoption and scaling up	The VMGs can easily utilize the innovation once sensitized
VMG related opportunities	- Use of milk for control of blight can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides - The use of milk may as a crop spray may present a scenario of making a choice between the innovation and nutrition needs especially for the ailing in cases where milk is not available in plenty
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

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)	3. requires further research
F: Contacts	
Contacts	Institute Director, KALRO Kandara, Centre Director, KALRO-Matuga
Lead organization and scientists	KALRO: Agnes Ndegwa, Finyange Pole, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&I, County governments, Universities

Gap

1. Validate Management of Early blight (*Alternaria solani*) by use of milk

2.4.16 TIMP Name	Crop rotation as a means of controlling diseases in tomatoes
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Disease build up in as a result of continuous cultivation of 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.
B: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
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 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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 50,000 per acre
Estimated returns	KES 500, 000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	Crop rotation can be easily practiced by all gender categories
Gender related opportunities	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
VMG issues and concerns in development, dissemination, adoption and scaling up	The VMGs can easily practice crop rotation once sensitized
VMG related opportunities	Crop rotation technology can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
E: Case studies/profiles of success stories	
Success stories	Cases to note are individual farmers and groups sensitized on importance of crop rotation in previous projects and are now practicing it in commercial 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)	2. Requires validation
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, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&I, County governments, Universities

2.4. 17 TIMP Name	Field sanitation as a means of controlling disease incidences
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	High disease causing pathogens accumulation and frequent attacks to tomatoes leading to high production costs 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 of the greenhouse is free from weeds and the surrounding areas are also clear of weeds and other crop residues. The water used for irrigation should be clean and free from disease causing pathogens. Equipment used for weeding, pruning as well as materials used for mulching should always be clean and free from disease causing organisms.
Justification	There is an increase in production costs for 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 thereby increasing the income levels of tomato producers.
B: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 80,000 per acre
Estimated returns	KES 500, 000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	Field sanitation can be easily practiced by all gender categories
Gender related opportunities	All gender categories can participate in field sanitation technology which has potential to increased yields of quality and safe tomatoes and reduce production costs
VMG issues and concerns in development, dissemination, adoption and scaling up	The VMG can easily participate in the crop rotation technology once sensitized
VMG related opportunities	Field sanitation technology can easily be undertaken by VMGs and hence lead to a reduction in costs for pesticides
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 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)	2. Requires validation
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, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&I, County governments, Universities

2.4.18 TIMP Name	Evaluation of fungicides for effectiveness in control of economic important diseases for tomato
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Presence of many and different types of fungicides in the market that are manufactured for use by tomato farmers for the control of diseases but there 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: Assessment of dissemination and scaling up/out approaches	
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.
C: Current situation and future scaling up	
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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 80,000 per acre
Estimated returns	KES 500, 000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	-Application of products may not be easily practical for some gender categories (spraying by women)
Gender related opportunities	-Participation of all gender categories in fungicides efficacy trials technology has potential to increase yields of quality and safe tomatoes and reduce production costs
VMG issues and concerns in development, dissemination, adoption and scaling up	Some VMGs (elderly, ailing) may not be able to easily participate in fungicides efficacy trials sensitized
VMG related opportunities	Able VMGs can participate in evaluating fungicides efficacy and hence lead to a reduction in costs for pesticides
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
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)	3. requires further research
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, Muo Kasina, Maina Mwangi, John Wesonga
Partner organizations	MoALF&I, County governments, Universities

2.4.19 TIMP Name	Tomato Grafting
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	High incidence of soil-borne disease such as bacterial wilt
What is it? (TIMP description)	This is a technique in which a plant with proven resistance to soilborne 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	Soilborne pathogens especially bacterial wilt caused by <i>Ralstonia solanacearum</i> are a major challenge to Tomato production. 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: Assessment of dissemination and scaling up/out approaches	
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"> - Sustained demand for disease resistant high yielding tomato seedlings - Favorable climatic conditions for tomato production - Collaboration between all partners

Partners/stakeholders for scaling up and their roles	KALRO, KU, JKUAT, County governments, farmer groups/CBOs, NGOs, private nursery operators.
C: Current situation and future scaling up	
Counties where already promoted if any	Not yet
Counties where TIMP will be upscaled	Kajiando, 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 learned 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.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 30 per seedling
Estimated returns	KES 500,000 per acre
Gender issues and concerns in development and dissemination	None
Gender related opportunities	-All gender categories can participate in tomato production and marketing which increases opportunities for income -In some regions women and youth lack access and control over resources for production and benefits
VMG issues and concerns in development, dissemination, adoption and scaling up	-Grafting may be a challenging technology to practice for VMGs who are physically challenged
VMG related opportunities	-VMGs can be involved in nursery operations and seedling sales.
E: Case studies/profiles of success stories	
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
F: STATUS OF TIMP READINESS (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation and further research
F: Contacts	

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&I, 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

2.4.20 TIMP Name	Disease resistant varieties
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
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: Assessment of dissemination and scaling up/out approaches	
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 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.
C: Current situation and future scaling up	
Counties where already promoted if any	None
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 learned 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.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Varies with variety
Estimated returns	KES 500,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	None
Gender related opportunities	-Any gender can participate in tomato production and marketing which increases opportunities for income -In some regions women and youth lack access and control over resources for production and benefits
VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	VMGs can be involved in different parts of the tomato value chain.
E: Case studies/profiles of success stories	
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
F: STATUS OF TIMP READINESS (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
F: Contacts	
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&I, 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

2.4.21 TIMP Name	Bio-control
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Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	High 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. Bi-ontrol 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: Assessment of dissemination and scaling up/out approaches	
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, farmers groups/CBOs, NGOs, agrovet dealers will implement extension.
C: Current situation and future scaling up	
Counties where already promoted if any	All areas where tomatoes are grown
Counties where TAMP will be upscaled	Kajiando, 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 learned in upscaling, if any	-Marketing of bio-pesticides needs an effective strategy -Better demonstration of their effectiveness necessary
Social, environmental, policy and market conditions necessary for development and upscaling	- Guidelines on pesticide residue limits for tomato -Favorable climatic conditions for tomato production -Sustained market demand for high quality tomato fruits.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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	None
Gender related opportunities	-Any gender can participate in tomato production and marketing which increases opportunities for income -In some regions women and youth lack access and control over resources for production and benefits
VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	VMGs can be involved in different parts of the tomato value chain.
E: Case studies/profiles of success stories	

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>Phytoseiulus</i> spp.), spiders, have been used in control of insect pests.
Application guidelines for users	Production guidelines are provided by bio-pesticide producers.
F: STATUS OF TIMP READINESS (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation and further research
F: Contacts	
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&I, 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.

2.4.22 TIMP Name	Trap crops
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	-High incidence of pests and disease -Inappropriate use of synthetic chemical pesticides
What is it? (TIMP description)	Trap cropping is a pest (nematode) management technique. A 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	Not known
B: Assessment of dissemination and scaling up/out approaches	
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, farmers' groups/CBOs, NGOs, will implement extension.
C: Current situation and future scaling up	
Counties where already promoted if any	Not known
Counties where TIMP will be upscaled	Kajiando, Kisumu, Siaya, Elgeyo Marakwet, Garissa, Mandera and others
Challenges in dissemination	-Destruction of the trap crop perceived as wasteful
Suggestions for addressing the challenges	-Use trap crop that has economic or nutrition value -Provision of knowledge on appropriate use of trap crops -Training and demonstration on trap crops -Economic analysis to convince growers on cost effectiveness
Lessons learned 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.	-Favorable climatic conditions for tomato production -Sustained market demand for high quality tomato fruits.

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	KES 500,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	None
Gender related opportunities	Any gender can participate in use of trap crops in tomato production and marketing which increases opportunities for income
VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	VMGs can utilize the practice as they engage in different parts of the tomato value chain.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Carrots can be used to trap root knot nematodes
Application guidelines for users	Guidelines are needed
F: STATUS OF TIMP READINESS (Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation and further research
F: Contacts	
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&I, County governments, Universities: KU, JKUAT

Research Gap

1. Validation of trap crop technology

2.4.23 TIMP name	Seed dressing for early pest management
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor plant establishment is often associated with early pest and disease infestation. 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 Xl® 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.
Region promoted	Kajiado (Plant raisers - Isinya), Kiambu, Naivasha (Longonot nurseries)
B: Assessment of dissemination and scaling up/out approaches	
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
C: Current situation and future scaling up	
Current extent of reach	Not adopted yet, require validation
Counties where already promoted, if any	none
Counties where TIMP will be upscaled	Kajiado, Kisumu, Siaya, Elgeyo- Marakwet, Garissa, Mandera,
Challenges in dissemination	None known
Suggestions for addressing the challenges	N/A
Lessons learned in upscaling, if any	N/A
Social, environmental, policy and market conditions necessary for development and upsaling	Not done
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined

Gender issues and concerns in development, dissemination, adoption and scaling up	No gender issue known
Gender related opportunities	- Technology can be adopted by either gender
VMG issues and concerns in development, dissemination, adoption and scaling up	-No VMG issue known
VMG related opportunities	- Technology can be adopted by all VMGs
E: Case studies/profiles of success stories	
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)	2. Requires validation
G: Contacts	
Contacts	Jomo Kenyatta University of Agriculture and Technology (JKUAT), Department of Horticulture and Food Security
Lead organization and scientists	JKUAT, John M. Wesonga, Boniface Muteshi, Francis Ombwara, Losenge Turoop
Partner organizations	KALRO Kandara, RealIPM, Koppert, BazerEA, DuduTech

2.4.24 TIMP name	Quarantine and movement restriction for management of pest and diseases
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	High 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. It is a first line of defense against pests that ensures minimal costs of dealing with pest outbreak. It contributes to product safety through minimal use of pesticides. 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: Assessment of dissemination and scaling up/out approaches	
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
C: Current situation and future scaling up	
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 learned in upscaling, if any	N/A
Social, environmental, policy and market conditions necessary for development and upsaling	Not done
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Variable depending on size
Estimated returns	No direct cost
Gender issues and concerns in development, dissemination, adoption and dscaling up	All gender categories can practice the improved management.
Gender related opportunities	-Reduction of pesticides creates a better working environment for women

	-Better practices can contribute to access to market and contribute to empowerment of the women
VMG issues and concerns in development, dissemination, adoption and scaling up	The better management is beneficial to all including VMG
VMG related opportunities	Better practices can contribute to access to market and contribute to empowerment of the VMG
E: Case studies/profiles of success stories	
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 (1. Ready for upsaling; 2. Requires validation; 3. Requires further research	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO Kandara
Lead organization and scientists	KALRO, Agnes Ndegwa, Rebecca Faraay
Partner organizations	JKUAT, MoALF&I, Seed Companies (e.g. Sygenta, Kenya Highland Seed Company, Amiran, Simlaw seeds), Agro-tunnel 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.

2.5 Harvesting

2.5.1 TIMP name	Maturity indices
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	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. The parameters are physical (colour, size, texture) and chemical (brix).
Justification	Tomatoes destined for various markets and end use should be harvested at the

	appropriate time. This ensures good quality of produce with long shelf-life. Many farmers especially new entrants into the market are not very familiar with the maturity indices for tomato and proper harvesting procedure. There is need for capacity building farmers on this aspect.
B: Assessment of dissemination and scaling up/out approaches	
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	Farmer Participatory Demonstrations/ Farmer field schools
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
C: Current situation and future scaling up	
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	-Indices are based on visual assessment and this may not be easy for some actors
Suggestions for addressing the challenges	-Capacity building with practical demonstrations
Lessons learned in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary for upscaling	-Organized marketing channels are critical for benefits to be derived from technology -
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	-The practice suitable for men, women and youth
Gender related opportunities	-All gender categories can easily use the technology in marketing of tomato to fetch good returns

VMG issues and concerns in development, dissemination, adoption and scaling up	-The practice is suitable for VMGs -Misconceptions about technology may affect adoption and scaling up
VMG related opportunities	-Use of appropriate maturity indices offers opportunities for marketing tomato fruit of high quality to fetch premium prices as a lucrative commercial venture for VMGs
E: Case studies/profile of Success stories	
Success stories from previous similar projects	Youth groups in Kiambu, farmers in peri-urban Nairobi County who utilize the appropriate maturity indices are doing good business
Application guidelines for users	Provide factsheet with detailed guidelines on tomato maturity indices in color
F: Status of TIMP readiness 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for up-scaling
G: Contacts	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Agnes Ndegwa, Gathambiri Charity, Wayua Francis
Partner organizations	JKUAT, MOA, Traders, Processors

2.5.2 TIMP name	Harvesting procedure
Category (i.e. technology, innovation or management practice)	Management Practices
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of information and expertise in appropriate harvesting practices to maintain tomato quality
What is it? (TIMP description)	- How to harvest fruit from plant -Use of proper harvesting containers -Time to harvest
Justification	Tomatoes destined for various markets and end use should be harvested using appropriate practices. This ensures good quality of produce with long shelf-life. Many farmers especially new entrants into the market are not very familiar with the proper harvesting procedures. There is need for capacity building farmers on this aspect.
B: Assessment of dissemination and scaling up/out approaches	
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	Farmer Participatory Demonstrations/ Farmer field schools
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
C: Current situation and future scaling up	
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 adherence to recommendations
Suggestions for addressing the challenges	-Continuous capacity building with practical demonstrations
Lessons learned in upscaling if any	Farmer participatory approach works
Social, environmental, policy and market conditions necessary for upscaling	-Organized marketing channels critical for benefits to be derived from technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	The practices are suitable for men, women and youth
Gender related opportunities	All gender categories can easily use the technology in marketing of tomato
VMG issues and concerns in development, dissemination, adoption and scaling up	-The practices are suitable for VMGs
VMG related opportunities	-Adherence to recommended harvesting procedures offers opportunities for lucrative commercial venture
E: Case studies/profile of Success stories	
Success stories from previous similar projects	Youth groups in Kiambu, farmers in peri-urban Nairobi County
Application guidelines for users	Use practical guidelines on how to harvest Provide fact sheets on harvesting
F: Status of TIMP readiness 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready to upscale
G: Contacts	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Agnes Ndegwa, Gathambiri Charity, Wayua Francis

Partner organizations	JKUAT, MOA, Traders, Processors
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2.6 Postharvest Handling

2.6.1 TIMP name	Postharvest handling practices
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of information and expertise in handling tomato produce after harvest which results in high postharvest losses
What is it? (TIMP description)	Good tomato postharvest handling practices include: -Proper harvesting and holding containers -Sorting and grading - Pre-cooling at farm level -Packaging (plastic crates) -Postharvest diseases management
Justification	Tomatoes are delicate fruits that require careful handling from harvesting up to market to ensure maintenance of good quality. Farmers and other actors at these chain levels do not always follow recommended practices. This leads to high postharvest losses. There is need to sensitize farmers and other chain actors on importance of proper postharvest handling and capacity build them on best practices.
B: Assessment of dissemination and scaling up/out approaches	
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 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

C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyaga,Tharaka-Nithi, Meru, Kajiado
Counties where TIMP will be upscaled	Siaya, Elgeyo- Marakwet, Garissa, Mandera, West Pokot
Challenges in dissemination	Limited extension officers with knowledge on postharvest handling procedures
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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	All gender categories can participate in tomato postharvest handling though some of the activities may not be easy for some gender categories for example- carrying, loading and stacking packed tomato crates is cumbersome for women -Cost may be prohibitive for some requirements
Gender related opportunities	-All gender categories can participate in various aspects of postharvest handling to ensure good tomato quality is maintained
VMG issues and concerns in development, dissemination, adoption and scaling up	-Some activities may not be suitable for VMGs
VMG related opportunities	-Good postharvest handling offers opportunities for a lucrative commercial venture for VMGs
E: Case studies/profile of Success stories	
Success stories from previous similar projects	-Horticultural growers in Tharka Nithi, Kirinyaga and Meru counties
Application guidelines for users	Tomato cultivation manual, brochures and factsheet with detailed guidelines on tomato postharvest handling practices are documented, Radio and TV broadcasts can also be used to promote the management practices
F: Status of TIMP readiness 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
F: Contacts	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors

Research Gaps

1. Evaluation of Tomato varieties for Processing and fresh market*

2.6.2 TIMP name	Charcoal cooler
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of cheap cooling technology for tomato produce at farm level to reduce postharvest losses
What is it? (TIMP description)	The Charcoal cooler is an evaporative cooling unit that offers short term storage of tomato. The cooling unit is constructed using cheap and locally available materials.
Justification	Tomato fruits are highly perishable therefore they should be at low temperature to enhance their shelf life. High temperature increases respiration rate and enhances postharvest rots. Cooling tomato at farm level improves the shelf life and maintains quality. The Charcoal cooling unit offers cost effective technology to maintain tomato produce in good quality and prolong shelf life and should be promoted.
B: Assessment of dissemination and scaling up/out approaches	
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
C: Current situation and future scaling up	
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	Limited materials to construct the charcoal cooler
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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	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 -Cost may be prohibitive for some requirements
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 exertion 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
E: Case studies/profile of Success stories	
Success stories from previous similar projects	-Youth groups in Kiambu, farmers in peri-urban Nairobi County
Application guidelines for users	Proper training on construction guidelines is very essential
F: Status of TIMP readiness 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
F: Contacts	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors

2.6.3 TIMP name	Modified Atmosphere Packaging (MAP)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	

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: Assessment of dissemination and scaling up/out approaches	
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
C: Current situation and future scaling up	
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

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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
E: Case studies/profile of Success stories	
Success stories from previous similar projects	-None
Application guidelines for users	-Brochures, Training module
F: Status of TIMP readiness 1) Ready for upscaling 2) Requires validation 3. Requires further research	Validation
F: Contacts	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua
Partner organizations	JKUAT,MOA, Traders, Processors

2.6. 4 TIMP name	Zero Energy cooling Unit
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Lack of cheap cooling technology unit for tomato produce at farm level to reduce postharvest losses
What is it? (TIMP description)	Zero energy cooler is an evaporative cold storage that offers short time storage for fresh produce. It reduces the temperature and increases relative humidity during storage essential in maintaining the freshness of the tomato. The cooler should be well-constructed to maintain low temperatures and high humidity inside the unit
Justification	Tomato fruits are highly perishable therefore they should be stored at low temperature and high relative humidity to enhance their shelf life. High temperature increases respiration rate and enhances postharvest rots. Cooling tomato at farm level improves the shelf life and maintains quality. Zero energy unit offers cost effective cold storage unit. The unit is developed using locally available materials that are environmental friendly.

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, traders, extension service providers
Approaches used in dissemination	None
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
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be upscaled	Siaya, Elgeyo- Marakwet, Garissa, Mandera, West Pokot
Challenges in dissemination	The technology requires validation
Suggestions for addressing the challenges	None
Lessons learned in upscaling if any	None
Social, environmental, policy and market conditions necessary for upscaling	-Organized marketing channels is critical for benefits to be derived from technology
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	-Technology can be easily applied by all gender categories -Cost may be prohibitive for some requirements
Gender related opportunities	-All gender categories can easily use the technology to ensure tomato quality is maintained
VMG issues and concerns in development, dissemination, adoption and scaling up	-Participation of some VMGs in capacity building sessions may be a challenge
VMG related opportunities	-The technology enhances opportunities for commercial venture for VMGs
E: Case studies/profile of Success stories	
Success stories from previous similar projects	None
Application guidelines for users	- Brochures and fliers to be documented
F: Status of TIMP readiness 1) Ready for upscaling 2) Requires validation 3. Requires further research	Validation
F: Contacts	

Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors

2.6.5 TIMP name	Improved packaging for Cherry tomatoes
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
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: Assessment of dissemination and scaling up/out approaches	
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
Most effective approach	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; Extension service providers for technology dissemination; Packaging material suppliers for design and supply of appropriate packaging material; Media for promotion
C: Current situation and future scaling up	
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.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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
E: Case studies/profiles of success stories	
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
F: Status of TIMP readiness (1. Ready for upsaling; 2. Requires validation; 3. Requires further research	2 requires validation
G: Contacts	
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

2.7 Value Addition

2.7.1 TIMP name	Processing of tomato into pulp
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
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: Assessment of dissemination and scaling up/out approaches	
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
C: Current situation and future scaling up	
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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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
E: Case studies/profile of success stories	
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
F: Status of TIMP readiness 1) Ready for upscaling 2) Requires validation 3. Requires further research	Ready for upscaling
G: Contacts	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors

2.7.2 TIMP Name	Solar drier to dehydrate tomato
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
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)	Solar drying is the use of solar energy to dehydrate tomato There are two types of solar driers namely natural convection solar and forced air convection solar drier. Natural convection drier is not suitable for small scale farmers due to low buoyance of air movement while forced convection improves rate of air movement. The tunnel drier which uses forced convection is recommended for dehydrating tomato.
Justification	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. Value added products fetch increased economic returns for farmers and other value chain actors. Dehydrating tomato also allows for further processing into other value added products and diversifies market and usage of tomato.
B: Assessment of dissemination and scaling up/out approaches	
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
C: Current situation and future scaling up	
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
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
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
E: Case studies/profile of success stories	
Success stories from previous similar projects	This has been done in Embu in other horticultural produce especially in mango
Application guidelines for users	Brochures and factsheets with detailed guidelines on tomato sauce documented, Radio and TV broadcasts, shows, trade fairs
Status of TIMP readiness 1) Ready for upscaling 2) Requires validation 3. Requires further research	Validation
G: Contacts	
Contacts	Kalro.kandara@kalro.org
Lead organization and scientists	KALRO: Charity Gathambiri, Francis Wayua
Partner organizations	JKUAT, MOA, Traders, Processors