



Climate Smart Agricultural Technologies, Innovations and Management Practices for Tomato Value Chain

TRAINING OF TRAINERS' MANUAL



MARCH 2020

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Foreword

Kenya Climate-Smart Agriculture Project (KCSAP) tasked the Kenya Agricultural & Livestock Research Organization (KALRO) with the implementation of the project Component 2, on ‘Strengthening Climate-Smart Agricultural Research and Seed Systems’. The component activities are geared towards the development, validation, adoption and delivery of context specific climate smart agriculture (CSA) technologies, innovation and management practices (TIMPS). The other responsibility was development of sustainable seed production and distribution systems for priority value chains to enhance availability and access to seed, breeds and fingerlings by target beneficiaries under Components 1 (Upscaling Climate-Smart Agricultural Practices). Against this background, KALRO and her NARS partners have developed, validated and availed CSA TIMPS for dissemination and adoption. The TIMPS have further been unpacked during the development of Training of Trainers (ToT) Manuals for use in training public and private extension service providers and lead farmers.

The ToT Manuals are instructional guides to be used for teaching and learning step-by-step procedures of implementing CSA innovations for each of the 13 value chains being addressed. The training content is drawn from the CSA TIMPS that support respective value chains. The content are arranged in progressive modules supported by extensive information from research information and background data drawn from the TIMPS. Their relevance are based on the needs teased out of the value chains and the project objectives. The ToT Manuals training design takes into consideration the delivery system, the partners and their roles, the duration of training and logical flow of the sessions. Similar content requiring similar delivery systems are grouped together while the roles of the partners are tapped in the training and planning of the training sessions.

The Manual is divided into modules, which have a uniform outline that ensures every aspect of the TIMPs are fully covered in way that the trainees can absorb and relate to. Various delivery methods are deployed and where possible demonstrations and practical work are incorporated to enable the trainees learn by participating in the actual field activities. Furthermore, to ensure that the training across various groups is standardized, trainers guidelines, detailed descriptions of the trainees, program, training methods and a training evaluation have been provided in the manual. Adhering to these guidelines, therefore, enables possibility to replicate the training in several locations without loss of details regardless of whether conducted by different trainers.

It is highly advised that the ToT Manuals should be used in conjunction with the respective value chains’ TIMPs documents and facts sheets in order to provide valuable resource for both public and private extension service providers. The use of this Manual is expected to spur increased productivity and resilience by farmers, while mitigating climate change

impacts in the value chains to deliver the envisaged ‘Triple Wins’.

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

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

Preface

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

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

To catalyze uptake of TIMPs, Kenya Agricultural & Livestock Research Organization (KALRO) in conjunction with partners in the National Agricultural Research Systems (NARS) and Consultative Group for International Agricultural Research (CGIAR) compiled inventories of TIMPs for each of the 13 prioritized value chains (cassava, green grams, sorghum, millet, pigeon peas, bananas, tomatoes, potatoes, apiculture, indigenous chicken (meat and eggs), dairy (cattle and camel), red meat (cattle, sheep and goats) and aquaculture and 3 cross cutting value chains (natural resource management, pastures and fodder and animal health). The TIMPs were categorized into those ready for upscaling, those that needed validation and gaps that required further research. Training of Trainers’ (ToT) manuals focusing on TIMPs that are ready upscaling for each of the value chains were subsequently developed and form the basis of training county extension staff, service providers and lead farmers. They are in turn expected to cascade this training to beneficiaries in the targeted smallholder farming, agro-pastoral and pastoral communities in the 24 project counties of Marsabit, Isiolo, Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.

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

The National Project Coordination Unit is grateful to all who participated in the development and production of this *Training of Trainers Manual for Climate Smart Agricultural Technologies, Innovations and Management Practices for Tomato Value Chain*. It is my hope that counties and other users will put this resource to good use as they transform and reorient their agricultural systems to make them more productive and resilient while minimizing GHG emissions under the new realities of a changing climate.

Francis Muthami

National Project Coordinator

Kenya Climate-Smart Agriculture Project

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ACRONYMS

ADSP Agricultural Development Support Project

AIP

BER	Blossom-end Rot
CCT	County Coordination Committee
CSA	Climate Smart Agriculture
CTT	Core Team of Trainers
FFBS	Farmer Field and Business Schools
FGDs	Focus Group Discussions
GAP	Good Agricultural Practices
IPM	Integrated Pest Management
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KALRO	Kenya Agricultural and Livestock Research Organization
KCSAP	Kenya Climate Smart Agriculture Project
KES	
KOPIA	Korean Program on International Agriculture
KU	Kenyatta University
LFs	Lead Farmers
MIAC	Mid-America International Agricultural Consortium
TNA	Training Needs Assessment
ToT	Training of Trainers
VMGs	



PART I

This part consists of four sections which include:

- Section 1: Background
- Section 2: Module Training Content
- Section 3: Training Design
- Section 4: Trainer's Guidelines.

SECTION 1: BACKGROUND

1.1 Importance of the Tomato Value Chain in the Kenyan Economy

Tomato (*Solanum lycopersicum* L.) is one of the most important vegetables grown for income and consumption in Kenya. It is high in nutraceutical value and is utilized fresh in salads or cooked in many local dishes and can also be processed to a range of value added products. Tomato have significant nutritional value. In recent years, they have become known as an important source of lycopene, which is a powerful antioxidant that acts as an anti-carcinogen. Tomato accounted for 38.1 percent by value of the exotic vegetables marketed in 2018 and was produced in an area of 28,263 ha with an output of 574,458 tons valued at KES 19.9 billion (HDC, 2019). Tomato production has potential for commercialization by small-holder farmers and other chain actors across the gender divide. There has been an upsurge in tomato production trends over the years which can be attributed to increased volumes and better farm gate prices in the main producing counties which include Kirinyaga, Kajiado, Taita-Taveta, Laikipia, Bungoma, and Trans-Nzoia, among others. This increase in production may be attributed to enhanced irrigation in open field cultivation, expansion in greenhouse production and spread of production in new areas.

However, various constraints hamper tomato production. The prevalence of tomato leaf miner, *Tuta absoluta* (Meyrick), an important pest in tomato production, bacterial wilt and late blight are the major challenges faced by tomato farmers. Other pests and diseases that constrain production include whiteflies, borers, Fusarium wilt, tomato spotted wilt virus, tomato yellow leaf curl virus and root-knot nematode. Factors such as lack of appropriate varieties for specific zones tolerant to biotic and abiotic stresses, poor agronomic practices (nutrient management and water use efficiency), physiological disorders (blossom end rot, sun-scald) and high postharvest losses also constrain tomato production. These challenges coupled with lack of value addition and marketing issues affect the profitability of tomato production. Development and promotion of climate smart technologies is the most effective strategy to address the prevalent constraints in order to improve performance the tomato value chain.

1.2 Objectives of the Manual

The purpose of this manual is to provide farmer trainers/trainers with knowledge and skills on how to facilitate and support farmer field and business schools (FFBS) for increased productivity through adoption of good agricultural practices (GAP). Specifically, the objectives of this training are:

1. Provide farmer's trainers with relevant altitude, knowledge and skill in tomato farming as a business and market assessment techniques for market led production
2. Refresh farmer trainers'/trainers' knowledge and skills in Tomato GAP including choice of appropriate varieties, clean seedling production and management of tomato crop in open field and greenhouse
3. Provide farmers trainers/trainers with knowledge and skills in value addition at individual or group level as post-harvest tomato management

4. Provide farmer trainers with knowledge and skills in participatory techniques for effective facilitation of adult learning processes through FFBS's and develop inclusive stakeholder partnerships for sustainable up scaling of FFBS.

After the training, the farmer trainers/trainers will train Lead Farmers (LFs) for a season long FFBS session on tomato GAPs. The FFBS training will involve providing the LF with techniques in participatory preparation, mobilization, planning, implementation, monitoring and evaluation of FFBS sessions. The lead farmers shall thereafter upscale the adoption of GAPs through farmer led FFBS, in their villages and those in neighbourhood.

1.3 About This Manual

This training manual consists of six key parts, including:

1. The content, orientation and outline of the training modules.
2. The training design.
3. Guidelines to the trainer for a successful training.
4. Adult learners training methods.
5. Evaluation of the Training
6. Important references for further reading.



SECTION 2: THE TRAINING MODULES CONTENT

1.1 Orientation of the Modules

The first part of this manual is about the training content or modules. It outlines the orientation and outline of the 15 modules which have a total of 4 sessions. The 15 modules cover GAPs in tomato value chain. The 15 modules are orientated so as to ensure CSA is adopted to improve productivity through improved Tomato value chain competitiveness in a market led production. During the Trainig Needs Assessment (TNA), farmers' priority needs in knowledge were: Tomato varieties with desired attributes e.g. tolerance to heat stress, good agronomic practices, soil nutrition and water management, pest and disease management, postharvest, value addition and marketing issues for increased productivity and commercialization.

1.2 Module Outline

Each of the 15 modules has basically the same outline consisting of 8 parts. These parts are:

- **Introduction to the Module** – context and background to training needs, knowledge and skills gaps being addressed
- **Module Learning Outcomes** – what trainees are expected to learn
- **Module Target Group** - trainee categories module users –trainers
- **Module Duration** – minimum number of hours of exposure to materials
- **Module Summary** – sequence of sessions, training methods, materials and duration
- **Trainers Guideline** – detailed sessions, training methods, materials and session guides
- **Participants' Handouts** – detailed notes and reference materials for trainees.

The outline of the 15 modules is presented in Table 1.

Table 1: Tomato value chain training Modules

No	Module Name	Need Addressed	Expected Training Outcomes	Duration
Table 1. Summary of outline for 15 modules of the Tomato Value Chain				
No.	Module name	Need addressed	Expected training outcomes	Duration
1	Climate Smart Agriculture Practices	Rapid growth in food demand intensified by the effects of climate change on agricultural systems, including crops, livestock, forestry and fisheries	<ul style="list-style-type: none"> Basics of climate science, the impacts of climate change and the linkages among climate, agriculture and food security 	2 hours
2	Farmer Field Business School (FFBS) approach	Lack of Understanding of Operations and dynamics of Tomato Farming Business	<ul style="list-style-type: none"> Farming business concept understood Tomato enterprise and business plans developed 	4 hours
3	Tomato Niches and Suitable Varieties	Lack of knowledge on the tomato varieties suitable for open field vs greenhouse cultivation Lack of demanded varieties with specific attributes (heat stress tolerant)	<ul style="list-style-type: none"> Knowledge gained on appropriate varieties for specific cultivation systems Attributes of different tomato varieties 	2 hours
4	Seeds/Seedling Production	Lack of awareness on the importance of raising tomato seedlings from certified seed -Limited skill in tomato nursery management	<ul style="list-style-type: none"> Awareness created on importance of raising clean seedlings Knowledge and skill acquired in raising clean tomato seedlings in open field nursery and greenhouse/shade-house nursery 	4 hours
5	Agronomic Practices for Open Field Tomato Cultivation	Lack of knowledge and skills on crop establishment and management	<ul style="list-style-type: none"> Knowledge and skills gained on tomato crop establishment in field Crop management practices understood 	3 hours

6	Greenhouse Tomato Cultivation	<p>-Inappropriate greenhouse designs for specific climatic zones</p> <p>-Lack of skills in greenhouse crop management</p>	<ul style="list-style-type: none"> • Knowledge gained on appropriate greenhouse designs and reputable greenhouse construction service providers • Knowledge and skill gained on step by step field establishment and management of tomato crop 	4 hours
7	Integrated Soil and Water Management Practices	<p>-Poor soil nutrient management</p> <p>-Lack of information on water requirements and efficient use</p>	<ul style="list-style-type: none"> • Soil nutrient management skills gained • Skills gained on water requirements and efficient use 	4 hrs
8	Tomato pests and their management	<p>-Limited knowledge on important pests identification and their management</p> <p>-Limited knowledge on pesticide application and safe use</p>	<ul style="list-style-type: none"> • Knowledge gained on Skills on identification of economic importance pests gained • Skills gained on management options for pests • Skills and knowledge gained on pesticides application and safe use 	3 hours

9	Tomato Diseases and their Management	<p>-Limited knowledge on important pests identification and their management</p> <p>-High incidence of physiological disorders (e.g. Blossom end rot, sun scald) in target areas</p>	<ul style="list-style-type: none"> • Knowledge gained on economic importance of diseases • Knowledge on identification of major diseases • Management options for Diseases • Knowledge on management of physiological disorders 	3 hours
10	Weeds Management in Tomato	Limited knowledge on weed identification and management	<ul style="list-style-type: none"> • Knowledge on identification of major weeds in tomato and their control 	3 hrs
11	Tomato Harvesting and Post-harvest Management	<p>-Immature and over mature harvesting of tomato</p> <p>Poor harvesting practices</p> <p>High post harvest losses</p>	<ul style="list-style-type: none"> • Knowledge gained on maturity indices, fruit harvesting technique, appropriate harvesting containers • Knowledge on good postharvest practices: • Sorting and grading • Packaging • Precooling • Transporting 	2 hours

12	Tomato Processing	Tomato post-harvest losses Low returns in tomato enterprise	<ul style="list-style-type: none"> • Knowledge and skills in tomato value addition (cottage level) and range of products • Making tomato sauce, ketchup, puree, juice • Dehydrated tomato slices and powder 	2 hours
13	Mechanization of Tomato Production Activities	Limited knowledge on mechanization in tomato	<ul style="list-style-type: none"> • Skills and knowledge in mechanization for tomato gained 	2hrs
14	Tomato Business and Marketing	Lack of market information on tomato	<ul style="list-style-type: none"> • Skills and knowledge gained on tomato business farming and marketing 	4 hrs
15	Tomato Cross Cutting Issues			
15.1	Agricultural Innovation Platforms	-Inadequate participation of stakeholders in value chain	<ul style="list-style-type: none"> • The attributes of an innovation platform appreciated and applied • Stakeholders mobilized to initiate an Agricultural Innovation Platform • Agricultural Innovation Platforms established, managed and monitored • The Agricultural Innovation Platforms and innovation capacity of AIP actors sustained 	2hrs

15.2	Tomato Gender, Vulnerable and Marginalized Groups (VMGs), Socio, Environmental Concerns and Cohesion	- Gender inequity and low integration of VMGs in tomato production	<ul style="list-style-type: none"> • Gender, youth and VMG inclusion strategies in tomato production learnt and disseminated. • Management Framework (ESMF) tool applied • Quantitative indicators on tomato sub-sector performance learnt and developed • Gender mainstreaming tool applied • Environmental and Social Management Framework (ESMF) tool used 	2hrs
15.3	Climate-Smart Agricultural Policy options	-Limited understanding of policy issues in the tomato value chain	<ul style="list-style-type: none"> • Policy issues in Tomato value chain understood 	2hrs
Total Duration				48 hours

SECTION 3: TRAINING DESIGN

3.1 Delivery System

The delivery system designed for this training consists of two stages:

3.1.1 Establishment of a team of trainers

- A Core Team of Trainers (CTT) trains farmer trainers as trainers in a 6 days ToT course. This is done using this manual and modules contained therein.
- Each of the Master trainers will facilitate farmers to acquire knowledge and skills in facilitating Farmer-led Field Schools (FFS) through practical demonstrations.

3.1.2 Up scaling.

- This will be done by selecting lead farmers (LF) to be trained in facilitation skills

3.2 Partners and their Roles

The partners envisioned in this training plan are:

1. **Core Team of the MoALFC Trainers-** Trainers drawn from KALRO and Department of Agriculture facilitate initial training of Master Trainers in the TOTs course. They also to provide mentorship to Master Trainers during the first year of lead farmer (LF) trainings. They should also be available in the evaluation of the first round of LF trainings.
2. **County Government Department of Agriculture-** Master Trainers and their supervisors who can be referred to as County Coordination Teams (CCT) to take the role of LF trainers, mentors and coordinators at sub county level. They assist FFS's form partnership with stakeholders for sustainability. They should also support LF's form their network.
3. **Lead Farmer Networks-**Association of LFs in the counties to take up farmer trainings and up scaling in the future. Lead farmer networks and groups will conduct exchange visits to learn best practices in other project implementing Counties.
4. **Private Sector Service Providers-** inputs suppliers, financial and business development service providers, market players and processors to partner and support growth of individual or tomato farmer groups. This is so as to evolve into sustainable social and commercial entities.

3.3 Training Duration

The proposed initial ToT course for farmer trainers that has 15 modules shall take a total of at least 48 hours of training materials. With a 6-day training plan, it is possible to have

6 days training consisting of 6 hours of training and 2 hours of mid-morning and afternoon tea and lunch breaks per day. Half a day of the first day allocated for official opening and climate setting. Another half-day of the last day for course evaluation, wrap up and closing ceremony.

3.4 Logic of Design and Flow of Sessions

The logic of design and flow of each module is that the trainer, paying attention to the proposed methods and sessions guidelines shall:

- i. Introduce the module.
- ii. Draw out the participants' expectations.
- iii. Relate participants' expectations with module objectives or learning outcomes.
- iv. Explore the concept and content, switching to different methods of delivery of the content (group exercise, brainstorming, excursions, plenary discussions, role plays) as the session progresses.
- v. Review the module at the end using participatory approaches with one participant reading a summary message and its application, and
- vi. Distribute the participants' hand outs.

SECTION 4: GUIDELINES TO THE Trainer

4.1 Preparation of the Training Materials

The training materials suggested require adequate preparations and should be available before the actual training dates. In addition:

- i. The trainers should familiarize themselves and internalize the guidelines provided by this manual early enough.
- ii. The stationery required should be available within the training institution 3 days before the training. These include name tags, flash drivers writing materials, paper punch and medium size box files for participants' handouts filing.
- iii. Flip charts and good quality felt pens could be used interchangeably with LCD projections also laser pointers. Each participant will require one felt pen while the trainers will require two sets of felt pens.
- iv. Visual aids like field equipment and tools should also be arranged in time before the sessions start.
- v. There should be adequate copies of participants' handouts (one per participant) to be distributed at the end of each session or as may be suitable.
- vi. Copies of the modules are distributed at the end of each module.

4.2 Preparation of Training Venue and Sites

The training venue will include the training room, field demonstration sites and sites acting as markets.

Training Room – should have adequate space for 25 participants seated in a semi-circle or U shape arrangement, ensuring access and unobstructed view of the front. There should be adequate space for a desk and seats for three trainers, preferably at the sides or at the back of the training room. There should also be a desk for the trainer, his /her materials and LCD projector, a flip chart holder and white wall to act as a projector screen.

Demonstration Site – should be a 5 minutes walking distance with at least 5 distinct tomato plots for practical during pests, diseases and crop management demonstrations. A clear seed bed should also be available for demonstrations on nursery establishment and transplanting techniques.

Market Sites – these include tomato retail outlets (kiosks, stalls, shops and supermarkets), whole sale and aggregation points and processing sites if any. The operators should be informed in advance about the visits. These should not be very far away, preferably less than 10 minutes' drive distance will do.

4.3 The Trainees

The trainees who will participate are service providers and County extension officers with elaborate training background in agriculture and extension. They all have considerable experience in training farmers albeit using less facilitative advisory or technology transfer approaches. The trainer should therefore act more of a trainer than a lecturer and draw out and build on their knowledge, skills and experience that they shall bring in. As a golden rule, do not lecture them but facilitate and listen and let them feel like equals to each other and the CTT team members.

4.4 Training Program

The training program proposed consists of the actual training modules including health breaks. The training program should preferably be based on the outline presented below in Table 2 to allow flow of ideas and topics. However, should the situation demand, the sequence and day of coverage for whole or parts of the modules can be modified to suit emerging requirements.

The training program presented (Annex 1) assumes that the trainees report on Sunday evening and leave six days later on Saturday afternoon or Sunday morning.

4.5 Training Methods

The training methods proposed for each session are suitable for adult learners and appropriate for addressing knowledge, skills and attitudes of the participants. The choice of the methods has been informed by the competency issues being addressed, time available and experiences of the author of this manual. The available training methods are presented in Table 2 below.

Table 2: Description of Training Methods

Training Method	Description of Method
Plenary presentations	Use of PowerPoint or flip charts and plenary discussions in situations where knowledge and opinion or consensus is required
Group exercises, buzz groups, visits and brainstorming sessions	To be considered where skills are an issue requiring sharing and trying
Role plays and problem-solving exercises	Plenary discussions have been considered as training methods where attitude is an issue
On-farm practical demonstration and exchange visits	To be considered where hands-on practical skills are acquired through sharing and demonstration

4.6 Planning Schedule and Guideline for ToT Preparation

While planning for this training, the CTT leader should ensure the following before the training:

Table 3 :Duration of activities to be done before training

Duration to Training	Activities to be Done
Six weeks	Recruit Master Trainers, compose CTT, identify the practical demonstration sites
Four weeks	Send out invitation letters to participants and special guests detailing purpose, venue and program. Follow up on demonstration sites. Brief CTT members
Two weeks	Confirm names of participants; reproduce training materials for trainers and package, confirm preparedness of the field sites to be visited. Hold briefing of CTT members to finalize training plan. Confirm special guests if any
Four days	Confirm training sites preparedness, prepare sitting arrangements and stationery, and brief assistants
One day	Arrange training room furniture, place materials, equipment and stationery on the tables. Arrange for the reception of trainees at residence proposed
On the first day	Arrange for the reception of trainees at the training venue. Ensure climate setting is done before the course is officially opened. This includes: (i) registration, (ii) welcome to the venue by host; (iii) elaborate introduction of CTT and participants; setting of ground rules; and (iv) formation of groups.

4.7 Evaluation of the Training

A half-day has been allocated for planning for way forward and evaluation of the ToT on the last day of the training. This is as shown in the program presented in Section 4.4. The evaluation strategy should take two directions the first being the individual trainees completing Evaluation Forms without conferring or refereeing to each other. The forms are then collected and analyzed by the CTT members.

Table 4: ToT Evaluation Form

Aspect/Module	Rating		
	Very useful (3 marks)	Useful (2 marks)	Least useful (1 mark)
Climate Smart Agriculture Practices			
Farmer Field Business school (FFBS) approach			
Tomato niches and suitable varieties			

Seeds/Seedling production			
Agronomic practices in open field tomato Cultivation			
Agronomic practices in greenhouse tomato cultivation			
Integrated soil and water management practices			
Pests management in tomato			
Tomato diseases and their management			
Weed management in tomato			
Tomato harvesting and postharvest handling			
Tomato processing			
Mechanization of tomato production activities			
Tomato business and marketing			
Tomato Cross Cutting Issues			
4.1: Agricultural Innovation Platforms			
4.2 Tomato Gender, Vulnerable and Marginalized Groups (VMGs), Socio, Environmental Concerns and Cohesion			
4.3 Climate-Smart Agricultural policy options			

The second direction for evaluation is trainees' group evaluation. They retreat to one room and elect a chair and a secretary. Ask them to objectively and constructively evaluate the training in about 45 minutes in the absence of the CTT members. They then present their evaluation to the CTT members and as they present, the CTT members should only give points of clarification if any misunderstanding occurred but should not try to be defensive. The CTT members then use the two evaluation results to write a report highlighting aspects that went on well and can be replicated, challenges that were encountered, and opportunities for future ToTs improvement.

4.8 Participant's Training Notes and Reference Materials

4.8.1 List of Tomato publications

The list of tomato publications is divided into two. The detailed list of all publications is summarized in Annex 2:

1. Publications for potential new entrants and new tomato farmers who have just started in the last 6-12 months (to be **Labelled A** in Table format).
2. More advanced level publications which can be understood and used by more established tomato farmers. (to be **Labelled B** in Table format).

4.8.2 Guide on the use of the information

The trainers will be advised to issue at most two publications for each of the training sessions. This is because if they go away with 10 publications, for example, in one visit they may be overwhelmed with the material load and thus limit knowledge uptake. Also, some will just take away as many as they can if allowed.

The list of all individual publications will be stored and available as electronic copies – mainly PDFs. The service providers are strongly advised to keep these electronic copies on a memory stick, or portable hard drive to enable farmers easily access and if necessary print any of them out at a local Cyber Café.

Trainers will be advised to issue a General Tomato Farming Manual to be accompanied by 2 other publications e.g. information sheets, brochures, factsheets, posters, etc. With subsequent training modules, they can develop their collection of publications.



PART II: TRAINING MODULES

This part presents the content of 15 modules namely: Climate smart Agriculture practices, Farmer Field Business School (FFBS) approach, tomato niche and suitable varieties, Seed/seedlings production, Agronomic practices in open field and greenhouse tomato cultivation, Integrated soil and water management practices, Tomato pests and their management, , Tomato diseases and their management, Tomato weeds and their management, Tomato harvesting and postharvest practices, tomato processing, Mechanization of tomato production activities, Tomato business and marketing and Cross cutting issues (including Agricultural Innovation Platforms, Tomato gender Concerns and Tomato policy).

The outline of each of the modules is as follows:

- 1 Introduction to the Module.
- 2 Module Learning Outcomes.
- 3 Module Target Groups.
- 4 Module Users.
- 5 Module Duration.
- 6 Module Summary.
- 7 Trainer's Guidelines.
- 8 Participant's Training Materials.

MODULE 1

CLIMATE SMART AGRICULTURE PRACTICES

1.1 Introduction to the Module

This module on Climate-Smart Agriculture (CSA) aims to take the learner from the basics of climate science to the impacts of climate change and the linkages among climate, agriculture and food security. Specifically, this module intends to answer the following questions:

- What is climate change and what are its causes?
- How will climate change affect agriculture and pastoral practices?
- What is climate smart agriculture?
- What are practical solutions that agricultural and pastoral producers can put into practice to deal with climate change effects?

1.2 Module Learning Outcomes

By the end of the module the following outcomes should be achieved .

1. Causes of climate change and impacts explained
2. Climate change impacts on agriculture and food security identified.

1.3 Module Target Groups

This module is intended for service providers and county public and private extension agents.

1.4 Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participants' handouts.

1.5 Module duration

The Module is estimated to take 7 hours.

1.6 Module Summary

Climate Smart Agriculture Practices			
Sessions	Training methods	Training materials	Time
1.6.1 Introduction, objectives and expectations	<ul style="list-style-type: none"> ▪ Personal introductions ▪ Presentation ▪ Plenary 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint 	15 minutes
1.6.2 Understanding climate change	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	30 minutes
1.6.3 Climate change impacts on agriculture and food security	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions ▪ Practical demo 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	30 minutes
1.6.4 Climate smart agriculture and context specific practices	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions ▪ Practical demo 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	30 minutes
1.6.5 Model review	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint ▪ Handouts 	15minutes
TOTAL			2 Hours

1.7 Trainers Guidelines

Climate Smart Tomato Systems and Best Management Practices	
1.7.1 Introduction, objectives and expectations	Session Guide
<p>Introduction (10 minutes)</p> <p><i>The trainer welcomes trainees to the module and introduces themselves by stating their profile and experience. The trainer invites the trainees to introduce themselves and state their expectations).</i></p> <p>Module Objectives (5 minutes)</p> <p><i>(The trainer presents modules objectives).</i></p> <p>By the end of the module training, the trainee should be able to:</p> <ul style="list-style-type: none"> • Describe climate change and impacts on food security. • Identify climate smart agriculture solutions for each of the target counties (refer to climate risk profiles for each value chains). 	<p>Summarize trainees' expectations and display</p> <p>Distribute handouts to trainees</p> <ul style="list-style-type: none"> • Module objectives • Training program
1.7.2 Understanding climate change (20 minutes)	Session guide
<p><i>(The trainer assists trainees to understand what climate change is, what causes it, what are the effects, and how to address them).</i></p> <p>Discussion (10 minutes)</p> <p>Let the trainees recall what they learned and discuss on any issue that may arise.</p>	<p>Distribute handouts to trainees</p> <p>Climate smart brochures, information sheets/leaflets and manuals</p>

1.7.3 Climate changes impacts on agriculture and food security (30 minutes)	Session guide
<p><i>(The trainer guides the trainees on how climate change is likely to affect agriculture: its effects on different types of farms, on men and women, and on food security).</i></p> <p>Plenary Presentation (20 minutes)</p> <p>Relationship between climate change and food security</p> <ul style="list-style-type: none"> • Effects of climate change on agriculture • How does agriculture contribute to climate change? • The link between climate change and food security <p>Discussion (10 minutes)</p> <p>Let the trainees recall what they learned and discuss on any issue that may arise</p>	<p>Distribute handouts to participants</p> <p>Climate smart brochures, information sheets/leaflets and manuals</p> <p>Q&A sessions</p>
1.7.4 Climate smart agriculture (30 minutes)	Session guide
<p><i>Present the following on PowerPoint slides and flip charts:</i></p> <p>Plenary Presentation (20 minutes)</p> <p>What is climate-smart agriculture</p> <ul style="list-style-type: none"> • Definitions and characteristics • Why climate smart agriculture • Principles of climate smart agriculture (triple wins) <p>Plenary Presentation</p> <p>Climate smart agriculture context specific practices</p> <p><i>Trainer presents PowerPoint slides highlighting some of the practices that ameliorate climate change.</i></p> <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<p>Distribute handouts to participants</p> <ul style="list-style-type: none"> • Climate smart brochures, information sheets/leaflets and manuals

1.7.5 Model review (15 minutes)	Session guide
<p><i>(The trainer leads the trainees in reviewing the module).</i></p> <p>Summarize the main points of the training</p> <p>Together with the trainees review the main points about climate-smart agriculture systems and best management practices.</p> <ul style="list-style-type: none"> • What new things did you learn from this module? • What are some of the problems and issues that you have become more aware of in the module? 	<p>Group discussions</p> <p>Q&A Session</p> <ul style="list-style-type: none"> ▪ Recap the main points ▪ Test understanding ▪ Link to the way forward ▪ Participatory evaluation of the session

MODULE 2

FARMER FIELD BUSINESS SCHOOL (FFBS) APPROACH

2.1 Introduction to the Module

This module is designed for training and exposing trainees to Farmer Field and Business Schools (FFBS) approach and concepts. In addition, practitioners of FFBS need to have knowledge of this methodology in order to mainstream various TIMPs in tomato enterprise. The trainees will thereafter facilitate farmers in the CIGs to enable them share and learn by doing, try available technologies and innovations as they implement them on their farms. FFBS also empowers the learners with various skills such as leadership, communication and business. Since the methodology is participatory, it improves the learners' observation skills and creates linkages with other value- chain players thereby making tomato enterprise profitable and sustainable.

2.2 Module Learning Outcomes

By the end of the module the following outcomes must be achieved:

- Have a clear understanding of Farmer Field and Business School approach and be able to differentiate between teaching and facilitating.
- Be equipped with practical skills that help them feel informed and confident about their roles and ability to facilitate a participatory learning session.
- Be empowered with knowledge and analytical skills to facilitate designing simple experiments to test and select the best solution to their (problem) challenges (TIMPs).
- Facilitate the shift from the traditional focus to improving productivity towards farming business proposition.

2.3 Module Target Group

These module targets agricultural extension service providers based at sub-county and ward level. It will also be useful for private extension service providers dealing directly with farmer groups at community level.

2.4 Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participants' handouts.

2.5 Module Duration

The Module is estimated to take a minimum of 4 hours

2.6 Module Summary

Introduction to Farmer Field and Farm Business School Approach			
Sessions	Training Methods	Training Materials	Time
1. Introduction and levelling of expectations	<ul style="list-style-type: none"> • Small and large group discussions • Presentation 	<ul style="list-style-type: none"> • Module objectives • Marker pens, flip charts • PowerPoint 	<ul style="list-style-type: none"> • 10 minutes
2. Introduction to FFBS	<ul style="list-style-type: none"> • Brainstorming • Plenary presentation 	<ul style="list-style-type: none"> • Flip charts • PowerPoint • Pictorials 	<ul style="list-style-type: none"> • 40 minutes
3. Designing an FFBS program	<ul style="list-style-type: none"> • Plenary presentations • Group Discussions and presentation 	<ul style="list-style-type: none"> • PowerPoint • Participants' handouts 	<ul style="list-style-type: none"> • 1 hour
4. Key activities in FFBS	<ul style="list-style-type: none"> • Plenary session • Group discussions • Group exercise 	<ul style="list-style-type: none"> • PowerPoint • Flip charts • Handouts (laying PTD) 	<ul style="list-style-type: none"> • 1 hour
5. Introduction to communication and facilitation skills	<ul style="list-style-type: none"> • Brainstorming • Plenary sessions • Group discussions 	<ul style="list-style-type: none"> • PowerPoint • Flip charts 	30 minutes
6. Organization, management and leadership in FFBS	<ul style="list-style-type: none"> • Brainstorming • Plenary sessions • Group discussions 	<ul style="list-style-type: none"> • PowerPoint • Flip charts • Handouts 	30 minutes
7. Module review	<ul style="list-style-type: none"> • Participants' questions and comments • Trainer' summary 	<ul style="list-style-type: none"> • Participants' handouts • Module review 	10 minutes
TOTAL			4 hours

2.7 Trainers Guidelines

2.6.1 Introduction And Levelling Expectations (10 minutes)	Session Guide
<p><i>(The trainer welcomes trainees to the module on FFBS and climate change and introduces him/herself stating his profile and experience of working with farmers).</i></p>	<ul style="list-style-type: none"> • Summarize Trainees' Expectations on a flipchart and make displays. • PowerPoint presentation

<p>The trainer invites the trainees to state their expectations.</p> <p>Module Objectives The trainer presents modules objective in PowerPoint.</p> <p>By the end of the module the trainee should be able to:</p> <ul style="list-style-type: none"> • Describe the concepts, characteristics, principles and plans of Farmer Field and Business School (FFBS) as a ‘learning by doing ‘approach. • Identify main differences between teaching and facilitation. • Be able to conduct Agro Ecosystems Analysis on tomato crop. • Successfully lay participatory technology development (PTD) on tomato TIMPs. 	
<p>2.6.2 Introduction To FFBS (40 minutes)</p>	<p>Session Guide</p>
<p><i>(The trainer should be able to introduce FFBS by defining it and sharing its benefits with the trainees).</i></p> <p>Plenary Presentation (40 minutes)</p> <ul style="list-style-type: none"> • History of Farmer Field and Business Schools • Principles of FFBS • Characteristics of FFBS • Concepts of FFBS • Objectives of FFBS • Benefits of FFBS 	<p>List the responses on flip chart</p> <ul style="list-style-type: none"> • PowerPoint presentation • Participants handouts
<p>2.6.3 The Key FFBS activities Steps in conducting FFBS (1 hour)</p>	<p>Session Guide</p>
<p>Plenary Presentation</p> <ul style="list-style-type: none"> • The concept of Agro Ecosystem (AESAs) • Participatory Technology Development • Group Dynamics • Special Topics in FFBS • Field daily Guide • Curriculum matrix for tomato <p>Group work Each group comes up with probable special topics to be covered within the learning period.</p>	<ul style="list-style-type: none"> • Distribute flipcharts and felt pens to group • Participants handouts • Ask one group member to present in plenary
<p>2.6.4 Designing an FFBS program (1hour)</p>	<p>Session Guide</p>

<p><i>(Trainer should guide discussions on the steps of preparation and establishment of FFBS)</i></p> <p>Plenary Presentation The classical steps</p> <ul style="list-style-type: none"> • ground working • Training of Trainers • Establishing PTDs at the FFBS • Season long FFBS sessions • Evaluation of PTDs • Field days • Graduation • Establishment of Lead Farmer FFBS • Follow ups <p>Group Exercise Steps in establishing FFBS in the community. Within the groups follow trainer’s instructions.</p> <p>Plenary presentation</p>	<ul style="list-style-type: none"> • Distribute Participants’ Handouts • Procedure of ground working- distribute handout • Powerpoint presentation • Group Exercise .
2.6.5 Communication skills (15 minutes)	Session Guide
<p>Plenary presentation <i>The trainer introduces the topic on communication and why effective communication.</i></p> <ul style="list-style-type: none"> • What is effective communication? • Purpose of communication • Barriers to effective communication • Maintaining communication within group (FFBS) 	<ul style="list-style-type: none"> • Group dynamics on communication-exercise • Distribute flip charts and felt pens to participants • Group Exercise
2.6.6 Facilitation skills (15 minutes)	Session Guide
<p><i>(The trainer introduces the topic on Facilitating adult learners).</i></p> <p>Plenary presentation Facilitating tomato CIGs</p> <ul style="list-style-type: none"> • Definition of facilitation, facilitate and effective trainer • Qualities of a good trainer • Golden rules of trainer • Roles and responsibilities of FFBS Trainers • Adult Non-formal learning techniques 	<ul style="list-style-type: none"> • Distribute flip charts and felt pens to participants • Handout on adult learning techniques
Organization, management and Leadership of FFBS	Session Guide

<p><i>(The trainer introduces the topic by asking the trainees how their groups are organized, managed and leadership structures).</i></p> <p>Plenary Presentation/Discussion</p> <ul style="list-style-type: none"> • What is leadership • Leadership continuum- subjects, environment and leader • Existing leadership structure • Roles & responsibilities of leaders • Leadership and sustainability in groups 	<p>Flip charts, PowerPoint, plenary discussions and presentations</p>
<p>2.7. Module Review (10 minutes)</p>	<p>Session Guide</p>
<p><i>(The trainer leads the trainees in reviewing the module).</i></p> <p>Together review the main points about FFBS module.</p> <ul style="list-style-type: none"> • What new things did you learn from this Module? • What are some of the problems and issues that you have become more aware of? In FFBS, problems are seen as challenges, how would we identify the priority problem in the community? • And how would we address it? • Why farming business proposition? • Any other question? questions 	<p>Flip charts, felt pens</p>

2.8 Participants' Handout

1. FFBS Fact sheet

References

1. FAO Government Cooperative Program: Farmer Field and Farm Business Schools. Manual for Preparation and Establishment of Farmer Field and Farm Business Schools
2. Khisa Godrick: Farmer Field School Methodology, Training of Trainers Manual.
3. FAO: Farmer Field School Methodology, a ToT Manual
4. Sustained East Africa: Farmer Field School, A Technical Manual
5. Training Manual on Good Agricultural Practices in Potato using Farmer Field and Business School Approach: KALRO and GiZ NuSePP

MODULE 3

TOMATO NICHEs AND SUITABLE VARIETIES

3.1 Introduction to the Module

This module is designed to train trainers of FFBS on tomato production niches and varieties suitable for cultivation in different AEZs and cultivation systems in the changing climate and farming environment. Trainers, service providers and lead farmers are exposed to the eco-climatic requirements (altitudes, soils, AEZs and climatic conditions) suitable for tomato production in the selected counties. Tomato are fairly adaptable to a wide climatic range but grow best at 1150 to 1800m above sea level in warm conditions with optimum temperatures of 15°-25°C. Very low temperatures delay colour formation and ripening while temperatures above 30°C inhibit fruit set, lycopene content flavour development. Tomato thrive best in low to medium rainfall with supplementary irrigation during the off-season. Greenhouse cultivation allows for tomato cultivation across a wide range of AEZs since the microclimate can be controlled. Tomato grow well in a wide range of soil types, which are high in organic matter, well-drained and with a pH range of 5-7.5. Tomato cultivation is done in both open field irrigated system and in greenhouses mainly by smallholder farmers. A wide range of tomato varieties are available in the market and farmers are faced with the challenge of deciding on the appropriate varieties to grow in their farms depending on the agro-ecological zone (AEZ) and the cultivation system practised. Determinate varieties are best suited to open field cultivation while indeterminate varieties are appropriate for greenhouse cultivation. There is also an emerging market for cherry tomato that farmers in some of the target counties, such as Mandera and Garissa are focusing on. The varieties differ in terms of critical attributes such as maturity period, fruit characteristics, yield, tolerance to biotic and abiotic stresses and marketability. There is therefore need to impart information on variety suitability to derive maximum output from tomato production systems.

3.2 Module Learning Outcomes

By the end of the module section the following outcomes should be achieved:

- Varieties suited to open field or greenhouse cultivation identified
- Advice on the attributes of these varieties provided
- Advice to farmers on source of seed for demanded varieties provided

3.3 Module Target Group and Categories

The target users of both modules are trainers, educators, county extension officers and model small and medium-scale tomato farmers.

3.4 Module Duration

The module is estimated to take 2 hours.

3.5 Module Users

This module will be used by Master Trainers (TOTs).

3.6 Module Summary

Tomato niches and suitable varieties			
Sessions	Training Methods	Training Materials	Time
1. Introduction and levelling of expectations	<ul style="list-style-type: none"> • Plenary presentation 	<ul style="list-style-type: none"> • Module objectives 	<ul style="list-style-type: none"> • 10 minutes
2. Introduction to Tomato variety categories/types	<ul style="list-style-type: none"> • Plenary presentation 	<ul style="list-style-type: none"> • PowerPoint, photos • Flip charts • Participants' Handouts 	<ul style="list-style-type: none"> • 10 minutes
3. Varieties for open field cultivation, -Descriptors and attributes	<ul style="list-style-type: none"> • Plenary presentation • Group Exercises 	<ul style="list-style-type: none"> • PowerPoint • Participants' handouts/ brochures 	<ul style="list-style-type: none"> • 10 minutes • 10 minutes
4. Varieties for Greenhouse cultivation -Descriptors and attributes	<ul style="list-style-type: none"> • Plenary presentation • Group Exercises 	<ul style="list-style-type: none"> • PowerPoint • Participants' handouts/ brochures 	<ul style="list-style-type: none"> • 10 minutes • 20 minutes
5. Sources of seed	<ul style="list-style-type: none"> • Plenary presentation • Group exercises 	<ul style="list-style-type: none"> • PowerPoint • Participants' handouts 	<ul style="list-style-type: none"> • 10 minutes • 10 minutes
6. Tomato field visit -Visit to field with tomato in open field and in greenhouse	<ul style="list-style-type: none"> • Practical 	<ul style="list-style-type: none"> • Field Demonstration 	<ul style="list-style-type: none"> • 30 minutes
7. Module review	<ul style="list-style-type: none"> • Trainer's summary • Group exercises 	<ul style="list-style-type: none"> • Participants' Handouts module review 	<ul style="list-style-type: none"> • 10 minutes
TOTAL			2 hours 30 minutes

3.7 Trainers Guidelines

3.7.1 Introduction And Levelling Expectations (10 minutes)	Session Guide
<p><i>(The trainer welcomes trainees to the module on Tomato varieties and introduces him/herself by stating his/her profile and experience of working with farmers.(The trainer invites the trainees to state their expectations).</i></p> <p>Module Objectives <i>(The trainer presents modules objectives)</i> By the end of the module training, the trainee should be able to:</p> <ul style="list-style-type: none"> • Identify varieties suited to open field cultivation of greenhouse • Provide advice on the attributes of these varieties • Provide advice to farmers on source of seed for demanded varieties. 	<p>Summarize Trainees’ “Expectations” and display.</p> <p>Distribute participant handouts, module objectives. session guide</p>
3.7.2 Introduction to Tomato varieties (30 minutes)	Session Guide
<p><i>(The trainer presents and discusses the different categories of tomato varieties in relation to open field and greenhouse cultivation as well as cherry tomato).</i></p> <p>Plenary Presentation Present categories of tomato varieties for field and greenhouse cultivation.</p>	<p>Distribute participants’ handouts, introduction to tomato varieties for open field cultivation</p>
3.7.3 Tomato varieties suitable for open field irrigated cultivation (20 minutes)	Session Guide
<p><i>(The trainer guides the trainees on how to identify the varieties suitable for open field cultivation.</i></p> <p>Plenary Presentation (10 minutes) Trainer presents descriptors and discusses varieties suited for open field cultivation.</p> <p>Group exercise (10 minutes) Identification of varieties for open field</p>	<p>List challenges on flip chart distribute participants’ handouts, descriptors</p> <p>Distribute participants’ handouts and brochures tomato variety catalogues with photos fruits of tomato varieties for open field cultivation</p>

3.7.4 Tomato varieties suitable for greenhouse Cultivation (20 minutes)	Session Guide
<p><i>(The trainer guides the trainees how to identify the varieties suitable for Greenhouse cultivation).</i></p> <p>Plenary Presentation (20 minutes) A presentation on varieties for greenhouse cultivation- showing photos and description.</p> <p>Group exercise (10 minutes) Identification of varieties for greenhouse cultivation</p>	<p>Distribute participants’ handouts and brochures tomato variety catalogues with photos fruits of tomato varieties for greenhouse cultivation</p>
3.7.5 Sources of Tomato seed of demanded varieties (20 minutes)	Session Guide
<p><i>(The trainer leads trainees to discuss challenges in seed sourcing and importance of using certified seed).</i></p> <p>Group Exercise (10 minutes) Pose this question “Where do you source tomato seed and what challenges are faced? Allow the trainees to mention out the challenges and list them on flip chart in a chronological order. Allow trainees to deduce from their discussion, the best sources of seed and packaging</p> <p>Plenary Presentation (10 minutes) Summarize the qualities of certified tomato seed as:</p> <ol style="list-style-type: none"> 1. Right variety for high yields and a good market demand 2. Properly packaged and labelled; traceable seed lot number 3. Within expiry period. <p>On-farm practical demonstration (30 minutes) <i>(The exercise should be done by the groups in preselected plots/site).</i> Visit tomato open field demonstration field and greenhouse. Let them give their experiences and what challenges they face in deciding which varieties to grow in open field.</p>	<p>Distribute participants’ handouts//brochures sources of tomato seed</p>

3.7.6 Review of Module (10 minutes)	
<p><i>(Trainer summarizes the main points of the training)</i></p> <p>Review the main points about tomato varieties and seed sources together with trainees.</p> <ul style="list-style-type: none"> · What new things did you learn from this module? · What are some of the problems and issues that you have become more aware of in tomato varieties and seed sources? · What questions do you still have about tomato varieties and seed sources? 	<p>Distribute participants' handouts/brochures</p> <p>Summary of Module</p>

3.8 Participant's Handouts

1. Tomato Varieties for Open Field Cultivation. Factsheet
2. Tomato Varieties for Greenhouse Cultivation. Factsheet

References

1. Tomato Cultivation Manual (KALRO revised edition 2015)
2. Tomato Cultivation Brochure (KALRO, 2016)
3. Tomato Varieties Seed Catalogues
4. Tomato Production Manual. Vincent Ochieng, et al, 2017.

MODULE 4

SEEDS / SEEDLINGS PRODUCTION

4.1 Introduction to the Module

This module is intended for use in training of master trainers in order for them to assist farmers improve production. Clean planting material is a pre-requisite for successful tomato production. However, use of poor quality seedlings obtained from dubious sources is a rampant practice. Some farmers also use “own seed”, “Kukamua mbegu”, extracted from previous crops. This is a risky practice since it not only adversely affects the overall performance of the succeeding crop, especially if extraction is from hybrid varieties, but also perpetuates seed borne diseases from one season to the next. The intervention targets sensitizing farmers on importance of raising seedlings properly on-farm using certified seed of preferred varieties. Tomato nursery can be established on beds in the open field or under protection in a greenhouse structure where seedlings can be raised in beds on the ground or in seedling containers (seedling boxes, trays, pots) filled with growing media (such as coco peat, pumice, humix and sterilized soil) placed on benches erected in the greenhouse structure.

4.2 Module Learning Outcomes

By the end of the module the following outcomes should be achieved:

- Appropriate seed quality for seedling establishment identified
- Use of various substrates for seedling production identified
- Use of various structures for seedling production explained
- Need for various management practices to produce high quality seedlings explained and applied.

4.3 Module Target Group

This module targets all crop extension officers, technicians and all private seed producers countrywide.

4.4 Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participant’s handouts.

4.5 Module Duration

The Module is estimated to take 6 hours

4.6 Module Summary

TOMATO SEED/SEEDLINGS PRODUCTION			
Sessions	Training Methods	Training Materials	Time
1 Introduction, objectives and expectations	<ul style="list-style-type: none"> ▪ Group Exercise ▪ Plenary presentations 	<ul style="list-style-type: none"> ▪ Handouts ▪ Module Objectives 	<ul style="list-style-type: none"> ▪ 10 minutes
2. Introduction to Tomato propagation and nursery management	<ul style="list-style-type: none"> ▪ Group Exercise ▪ Plenary presentation 	<ul style="list-style-type: none"> ▪ Participants' Handouts ▪ Flip charts 	<ul style="list-style-type: none"> ▪ 10 minutes ▪ 20 minutes
3. Nursery site selection establishment and management in open field	<ul style="list-style-type: none"> ▪ Plenary presentation ▪ Field practical on nursery preparation 	<ul style="list-style-type: none"> ▪ PowerPoint presentation ▪ Flip charts ▪ Participants' ▪ Handouts ▪ Open field plot ▪ Farmyard manure (M= FYM) ▪ Fertilizer ▪ Jembes, spades polythene paper ▪ Tape measure, ▪ Pegs, ▪ Seedling boxes 	<ul style="list-style-type: none"> ▪ 1 hour
4. Seeding	<ul style="list-style-type: none"> ▪ Plenary Presentations ▪ On-farm practical demonstration of seeding ▪ Group work 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Sample seeds ▪ Watering can 	<ul style="list-style-type: none"> ▪ 30 minutes

5. Greenhouse Nursery set up and Management	<ul style="list-style-type: none"> ▪ Plenary presentation ▪ Practical demonstration 	<ul style="list-style-type: none"> ▪ PowerPoint presentation ▪ Participants' Handouts ▪ Seedling containers ▪ Greenhouse/ screenhouse with benches for placing seedling containers ▪ Media (cocopeat, treated soil, humis, vermiculite etc) 	1 hr
6. Selection and Preparation of seedlings for transplanting	<ul style="list-style-type: none"> ▪ Plenary Presentations ▪ Practical demonstration of seedling selection and transplanting ▪ Group work 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Seedlings ▪ Jembes(hoe) ▪ Fertilizer ▪ Tape measure ▪ Weighing balance 	<ul style="list-style-type: none"> ▪ 30 minutes
7 Tomato grafting	<ul style="list-style-type: none"> ▪ Plenary Presentations ▪ On-farm practical demonstration of grafting ▪ Group Exercises 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Structures ▪ Tomato seedlings and scions ▪ Grafting knives and tape 	<ul style="list-style-type: none"> ▪ 1 hours
8. Module review	<ul style="list-style-type: none"> ▪ Participants' questions and comments ▪ Trainer's summary 	<ul style="list-style-type: none"> ▪ Participants' Handouts ▪ Module review 	<ul style="list-style-type: none"> ▪ 20 minutes
TOTAL			4 hours

4.7 Trainers Guidelines

4.7.1 Welcome And Levelling Expectations (10 minutes)	Session Guide
<p><i>(Trainer welcomes trainees to the module Tomato nursery establishment and Management and introduces him/her by stating his profile and experience of working with farmers).</i></p> <p>The trainer invites the trainees to state their expectations.</p> <p>Module Objectives</p> <p>By the end of the module the trainee should be able to:</p> <ul style="list-style-type: none"> • Select/acquire good quality seeds • Prepare and solarize beds, sow and care for seed beds for optimum germination and emergence • Select, construct and utilize appropriate structures and use appropriate substrates for raising high quality seedlings • Apply appropriate management practices in the nursery • Produce grafted seedlings • Identify ready seedlings and prepare them for transplanting. 	<p>Distribute participants' handouts</p>
4.7.2 Introduction to propagation and Nursery Management (30 minutes)	Session Guide
<p>Group exercise on participants' experience (20 Minutes)</p> <p><i>(The trainer leads trainees discuss activities and challenges in tomato nursery establishment and management).</i></p> <p>Summarize Tomato Nursery establishment and management</p>	<p>Distribute Participants' Handouts</p> <p>Summarize responses on a flip chart and display</p>

4.7.3 Nursery site selection, Establishment and management in open field	
Plenary Presentation (30 minutes)	
<p><i>(The trainer presents the criteria for nursery site selection and step by step procedure of nursery establishment).</i></p> <p>Present PowerPoint slides on criteria to consider when selecting nursery site (open field).</p> <p>Group Exercise (30 minutes)</p> <p><i>Trainer guides session on experiences and question and answer. (Discussion on trainees' experience and plenary presentation).</i></p>	<p>Distribute Participants' Handouts</p>
4.7.4 Seed selection/acquisition and seeding	
<p><i>(The trainer guides and explains sources of good quality seed and sowing techniques) (30 minutes).</i></p> <p>Plenary presentation</p> <p>Present on the following:</p> <ul style="list-style-type: none"> ▪ Tomato seed sources ▪ Assessing seed quality ▪ Seed handling ▪ Preparation of beds ▪ Sowing of seeds 	

4.7.5 Substrates for greenhouse seedling production	
<p><i>(The trainer shall describe and demonstrate various substrates for seedling production).</i></p> <p>Plenary presentation (30 minutes)</p> <p>Present on the following:</p> <ul style="list-style-type: none"> ▪ Sources of substrates ▪ Types of substrates ▪ Factors to consider in substrate selection ▪ Preparation of substrates and amendments ▪ Seedling containers ▪ Seeding <p>Group exercise (1 hour)</p> <p><i>(The trainer shall describe and demonstrate various substrates for seedling production).</i></p> <p>Preparation of substrates and amendments</p>	
4.7.6 Structures for seedling production	
<p>Describe and demonstrate structures for seedling production (30 minutes):</p> <ul style="list-style-type: none"> ▪ Types of structures used for seedling production ▪ Shade nets, low/high tunnels, shade/lath houses etc. ▪ Maintenance of structures 	
4.7.7 Tomato grafting	
<p><i>The trainer shall describe and demonstrate grafting of tomato (1 hour).</i></p> <ul style="list-style-type: none"> • Reasons for grafting • Selection of scions and rootstocks • Grafting techniques • Management of grafted seedling • Assessment of graft take (success) 	

4.7.8 Review of module (20 minutes)	
<p><i>(Trainer summarizes the main points of the training).</i></p> <p>Review the main points about tomato varieties and seed sources together with trainees.</p> <ul style="list-style-type: none"> · What new things did you learn from this Module? · What are some of the problems and issues that you have become more aware of in Tomato seed/seedlings production? <p>What questions do you still have about tomato varieties and seed sources?</p>	<p>Distribute participants' handouts/brochures</p> <p>Summary of Module</p>

4.8 Participants' Handouts (Training and Reference Materials)

4.8.1 Handouts

1. Vegetable Nursery Practices. Compiled by: Faraay R.N, Ndegwa A and Gwandaru J. KALRO HRI. 2016
2. Tomato Nursery establishment and management. Factsheet

4.8.2 References

1. Plant Propagation and Nursery Management
2. AVRDC – The World Vegetable Center Raising healthy tomato seedlings handbook (Lin L-J, Luther GC, Hanson P. (2015). Raising healthy tomato seedlings. AVRDC – The World Vegetable Center publication #15-795. 15 p.
3. AVRDC – The World Vegetable Center Vegetable nursery and tomato seedling management guide for South and Central India handbook (Bharathi PVL, Ravishankar M. 2018. Vegetable nursery and tomato seedling management guide for south and central India. World Vegetable Centre Publication No. 18-829. World Vegetable Center, Taiwan. 30 p)

MODULE 5

AGRONOMIC PRACTICES IN OPEN FIELD TOMATO CULTIVATION

5.1 Introduction to the Module

This module is designed for Master trainers in proper agronomic practices in open field tomato cultivation for improved yields. These practices range from site selection, land preparation, transplanting, fertilizer application, weeding, irrigation, staking, pruning, to pre-harvesting. Tomato farmers in some cases apply inappropriate agronomic practices and hence fail to achieve the expected yields. Tomato growing requires good agronomic practices for optimal yields and increased incomes. Poor site selection, land preparation, low plant density, irregular watering, lack of pruning and weeds reduce yields. Farmers attribute the low yields to wrong causal factors for instance poor seed, soil, or “cold weather” for low tomato yields. At times farmers are unable to visualize the cause and effect relationship between factors of production and yields. Some aspects affect yields and increase costs of production but where most cultural activities are carried out as recommended, farmers achieve high yields. Most cultural and field activities if carried out well can reduce the need for increased use of agrochemicals thus resulting in reduced environmental degradation, increased savings and consequently increased incomes.

There is need for capacity building and demonstration of good agronomic practices to improve open field tomato cultivation. This module aims at importing the learning outcomes necessary for adoption of these field practices.

5.2 Module Learning Outcomes

By the end of the module the following outcomes should be achieved:

- Agronomic practices in open field tomato identified and explained
- In-depth knowledge of proper agronomic practices in tomato cultivation provided.

5.3 Module Target Group

The module targets Service Providers and County Public extension staff.

5.4 Module Users

The module users are the Master Trainers (TOTs).

5.5 Module Duration

The module is estimated to take a minimum of 6 hours 50 minutes.

5.6 Module Summary

AGRONOMIC PRACTICES FOR OPEN FIELD TOMATO CULTIVATION			
Sessions	Training Methods	Training Materials	Time
1. Introduction and levelling of expectations	<ul style="list-style-type: none"> • Groups discussion • Plenary Presentation 	<ul style="list-style-type: none"> • Module objectives • Marker pens, flip chats • PowerPoint 	<ul style="list-style-type: none"> • 20 minutes
2. Introduction to Agronomic Practices	<ul style="list-style-type: none"> • Brain storming • Plenary presentation 	<ul style="list-style-type: none"> • Flip charts • PowerPoint • Participants' handouts 	<ul style="list-style-type: none"> • 20 minutes • 10 minutes
3. Site selection, Land Preparation and crop rotation	<ul style="list-style-type: none"> • Plenary presentations • Group exercises 	<ul style="list-style-type: none"> • PowerPoint • Participants' handouts 	<ul style="list-style-type: none"> • 30 minutes
4. Transplanting, Spacing and Fertilizer application	<ul style="list-style-type: none"> • Plenary presentation • Simulation exercise • Discussions of the exercise 	<ul style="list-style-type: none"> • PowerPoint • Participants' handouts • Farm at training site 	<ul style="list-style-type: none"> • 30 minutes
5. Weeding, Mulching and Irrigation	<ul style="list-style-type: none"> • Plenary presentation • Simulation exercise • Group exercise 	<ul style="list-style-type: none"> • PowerPoint • Participants' handouts • Farm at training site 	<ul style="list-style-type: none"> • 40 minutes
6. Staking, Pruning, De-flowering and Defoliation	<ul style="list-style-type: none"> • Plenary presentation • Simulation exercise • Group exercise 	<ul style="list-style-type: none"> • PowerPoint • Participants' handouts • Farm at training site 	<ul style="list-style-type: none"> • 40 minutes
7. Module review	<ul style="list-style-type: none"> • Group exercise • Trainer's summary 	<ul style="list-style-type: none"> • Participants' handouts • Module review 	<ul style="list-style-type: none"> • 10 minutes
TOTAL			3 hours 20 minutes

5.7 Trainers guidelines

5.7.1 Introduction and levelling expectations (20 minutes)	Session Guide
<p><i>(The trainer welcomes trainees to the module on agronomic practices in open field tomato cultivation and introduces him/herself stating his profile and experience of working with farmers).</i></p> <p><i>The trainer invites the trainees to state their expectations.</i></p> <p>Module Objectives</p> <p><i>(The trainer presents modules objectives).</i></p> <p>By the end of the module the trainee should be able to:</p> <ul style="list-style-type: none"> ● Explain the benefits of good agronomic practices in tomato production. ● Facilitate farmers adopt proper tomato agronomic practices. 	<p>Summarize Trainees' Expectations on a flipchart and make displays.</p> <p>Distribute participants' Hand outs</p>
5.7.2 Introduction to crop agronomic practices in open field (30 minutes)	Session Guide
<p><i>(The trainer introduces agronomic practices by defining them and sharing benefits with the trainees. The trainer then leads the trainees in discussing the various agronomic and field management practices. He /she reminds them that irrigation, soil fertility and crop protection are covered in details in their stand-alone modules).</i></p> <p>Brainstorming</p> <p>Inform the trainees that the issues to be discussed in this module are:</p> <ul style="list-style-type: none"> ● Site preparation and crop establishment –site selection, preparation of holes, application of FYM and fertilizer, transplanting seedlings. ● Field management practices – watering/irrigation, weeding, staking, pruning. <p>Plenary Presentation</p> <p>Trainer presents on the agronomic and field management practices. Inform trainees that the details on irrigation, soil fertility management.</p>	<p>List the responses on flip chart</p> <p>Distribute participants' hand outs</p>

5.7.3 Site selection, land preparation and crop rotation (30 minutes)	Session Guide
<p><i>(The trainer engages the trainees in discussions on site selection, seed bed preparation, and tomato transplanting).</i></p> <p>Group Exercises</p> <p>Ask the trainees to give their views on suitable site selection and criteria for this. Let them explain how land should be prepared and crop rotated.</p> <p>Plenary Presentation</p> <p>Trainer presents on suitable site selection, land preparation and crop rotation. Use the site selection criteria as:</p> <ul style="list-style-type: none"> • Field history • Topography, drainage and soil type and characteristics • Ease of access for farm operations and monitoring. 	<p>Distribute participants' Handouts</p> <p>Distribute participants' Handouts</p>
5.7.4 Transplanting, spacing and fertilizer/manure application (40 minutes)	Session Guide
<p>Plenary Presentation</p> <p>Trainer presents and simulates the process of transplanting of seedlings in the holes and their correct spacing.</p> <p>Presentation should explain nutrition management (Fertilizer/manure application)</p>	<p>Distribute participants' Handouts</p>
5.7.5 Weeding, mulching and irrigation (40 minutes)	Session Guide
<p>Plenary Presentation</p> <p>The trainer makes presentations on</p> <ul style="list-style-type: none"> • The importance of weeding and types of weeding • The importance of mulching • The importance of irrigation and management. <p>The trainer should simulate how each of the above are done in the field.</p>	<p>Distribute participants' Handouts</p>
5.7.6 Plant support, pruning, deflowering and defoliation	
<p>Plenary Presentation</p> <p>The trainer makes a presentation to:</p> <ul style="list-style-type: none"> • Explain the importance of tomato support/staking, staking materials • Explain advantages and disadvantages of staking • Explain process of pruning, deflowering and defoliation • Discuss importance of pruning, deflowering and defoliation. 	<p>Distribute participants' Handouts</p>

5.7.6 Module review (10 minutes)	Session Guide
<p><i>(The trainer leads the trainees in reviewing the module as a group and then gives a presentation on the module review. Conclude by thanking the participants).</i></p> <p>Group Exercise</p> <p>Review together the main points about agronomic practices;</p> <ul style="list-style-type: none"> · What new things did you learn from this module? · What are some of the problems and issues that you have become more aware of in agronomic practices? · What questions do you still have about agronomic practices? <p>Plenary presentation</p> <p>Summarize the main points of the training in the module.</p>	<p>Distribute handout</p> <p>Module review</p>

5.8 Participants Handouts

Tomato Open-field Cultivation Practices. Factsheet

References

1. Tomato Cultivation Manual (KALRO revised edition 2015).
2. Tomato Production manual, 2017.

MODULE 6

GREENHOUSE TOMATO CULTIVATION

6.1 Introduction to the Module

Tomato is one of the most important crops in Kenya with high market demand for quality fruits and their value added products. Tomato production has potential to address food and nutrition security as well as wealth creation resulting in empowerment. Open field cultivation which is often practised is hindered by various challenges which can be overcome using greenhouses. Greenhouse technology has been posed to be a cost-effective solution to address the issues in tomato cultivation in Kenya. These are key technologies that can be used to enhance productivity and deal with various production challenges. Greenhouse tomato farming has the potential of achieving higher yields on the same amount of land, compared to open-field farming.

The module seeks to address the issues of inappropriate greenhouse designs for specific climatic zones and lack of skills in greenhouse crop management. It covers technologies and practices applicable to greenhouse tomato as follows:

- Improved greenhouses for production of high quality tomato
- Use of coco-peat for tomato production
- Use of Styrofoam boxes or plastic flats and raised horizontal planting troughs
- Nutrition management
- Staking and pruning
- Irrigation using drip irrigation and capillary wick methods
- Bio-degradable mulching materials for weed management and moisture retention.

6.2 Module Learning Outcomes

By the end of the module, the following outcomes should be achieved:

- Key features of an appropriate greenhouse for tomato production described
- Preparation and use cocopeat for production of tomato demonstrated
- Use styrofoam boxes and raised horizontal planting troughs for tomato production demonstrated
- Practices for effective nutrient management identified and tried
- Staking and pruning of tomato demonstrated
- Use drip irrigation and capillary wick methods for tomato production demonstrated

Use bio-degradable mulching materials for weed management and moisture retention identified and tried.

6.3 Module Target Group

This module targets crops extension officers, tomato growers, youths and interns.

6.4 Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participants' handouts.

6.5 Module Duration

The Module is estimated to take a minimum of four hours

6.6 Module Summary

Greenhouse Tomato Cultivation			
Sessions	Training Methods	Training Materials	Time
6.6.1 Introduction, objectives and expectations	<ul style="list-style-type: none"> ▪ Personal introductions ▪ Presentations 	<ul style="list-style-type: none"> ▪ PowerPoint 	10 minutes
6.6.2 Introduction to greenhouse tomato production	<ul style="list-style-type: none"> ▪ Presentations ▪ Q&A 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	10 minutes
6.6.3 Appropriate greenhouses for production of high quality tomato	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical examination of seeds ▪ Group work 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Video clip ▪ Handouts ▪ Greenhouse 	30 minutes
6.6.4 Media for greenhouse tomato production	<ul style="list-style-type: none"> ▪ Presentations ▪ Group work ▪ Practical examination of samples 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Cocopeat 	30 minutes

6.6.5 Planting systems for greenhouse tomato production	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical demonstrations of propagation structures ▪ Group work 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Planting systems 	30 minutes
6.6.6 Nutrition management	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical tasks on nutrition management ▪ Group work 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Sample fertilizers 	30 minutes
6.6.7 Training and pruning	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical observation of pest and disease samples ▪ Group work 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Greenhouse production system 	30 minutes
6.6.8 Irrigation using drip and capillary wick methods	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical demonstrations of transplants ▪ Group work 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Irrigation systems 	30 minutes
6.6.9 Bio-degradable mulching materials for weed management and moisture retention	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical demonstrations of transplants ▪ Group work 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Greenhouse production system 	30 minutes
6.6.10 Model review	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ flip charts ▪ PowerPoint ▪ Handouts 	10 minutes
TOTAL			4 hours

6.7 Trainer's Guidelines

6.7.1 Introduction, objectives and expectations (10 minutes)	Session Guide
<p>Introduction</p> <p><i>(The trainer welcomes trainees to the module to introduce themselves by stating their profile and experience).</i></p> <p>The trainer invites the trainees to introduce themselves and state their expectations.</p> <p>Module Objectives</p> <p><i>(The trainer presents the objectives of the module)</i></p> <p>By the end of the module the trainee should be able to:</p> <ul style="list-style-type: none"> • Describe key features of an appropriate greenhouse for tomato production and undertake minor repairs. • Prepare and use cocopeat for production of tomato. • Use styrofoam boxes and raised horizontal planting troughs for tomato production. • Carry out practices for effective nutrient management • Carry out staking and pruning of tomato. • Use drip irrigation and capillary wick methods for tomato production. • Use bio-degradable mulching materials for weed management and moisture retention. 	<p>Summarize trainees expectations and display</p> <p>Distribute handouts to participants</p> <ul style="list-style-type: none"> • Module objectives • Program
6.7.2 Introduction to greenhouse tomato production (10 minutes)	Session guide
<p>Plenary Presentation (45 minutes)</p> <ul style="list-style-type: none"> • Importance of tomato • Production situation and key challenges • Importance of greenhouse tomato • Group discussion and presentation on challenges in greenhouse tomato production <p>Discussion (15 minutes)</p> <p>After the session, the trainer lead the participants in a Q&A session on the issues covered and any other emerging ones</p>	<ul style="list-style-type: none"> • Distribute handouts to participants • Presentation • Q&A • Discussion <p>Q&A sessions</p>

6.7.3 Improved greenhouses for production of high quality tomato (30 minutes)	Session guide
<p>Plenary Presentation (30 minutes)</p> <ul style="list-style-type: none"> • Definition of greenhouses • Types of greenhouses • Benefits of greenhouse • Key features of a good greenhouse • Maintenance and repair of greenhouse • Participants shall be taken around the greenhouses and key features demonstrated <p>Discussion (30 minutes)</p> <p>After the session, the trainer shall lead trainees in a Q&A session on the issues covered and any other emerging ones</p>	<ul style="list-style-type: none"> • Distribute handouts to participants • Presentation • Q&A • Discussion • Demonstration <p>Q&A sessions</p>
6.7.4 Use of cocopeat for greenhouse tomato production (30 minutes)	Session guide
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> • Description of cocopeat • Sources of cocopeat • Advantages of cocopeat • Explanation and practical preparation of cocopeat for use 	<ul style="list-style-type: none"> • Distribute handouts to participants • Presentation • Examination of samples and discussion <p>Q&A sessions</p>

6.7.5 Planting systems for greenhouse tomato production (3 hours)	Session guide
<p>Presentation (20 minutes)</p> <ul style="list-style-type: none"> • Plenary description of planting systems • Beds preparation • Explanation of horizontal planting troughs • Description of styrofoam boxes and their use • Practical setting up of horizontal planting troughs and styrofoam box systems <p>Discussion (10 minutes)</p> <p>After the session, the trainer shall lead trainees in a Q&A session on the issues covered and any other emerging ones</p>	<ul style="list-style-type: none"> • Distribute handouts to participants • Presentation • Examination of samples and discussion <p>Q&A sessions</p>
6.7.6 Nutrition management (30 minutes)	Session guide
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> • Media (soil, soilless) analysis • Nutrient deficiency symptoms • Soil and leaf tissue analysis and use of test results • Types of fertilizers • Application of fertilizers • With guidance, participants prepare nutrient solution and determine electrical conductivity (EC) <p>Discussion (10 minutes)</p> <p>After the session, the trainer shall lead trainees in a Q&A session on the issues covered and any other emerging ones</p>	<ul style="list-style-type: none"> • Distribute handouts to participants • Presentation • Demonstration and practice <p>Q&A sessions</p>

6.7.7 Staking and pruning (30 minutes)	Session guide
<p><i>The topic shall be covered as follows (20 minutes)</i></p> <ul style="list-style-type: none"> ▪ Definition of staking and pruning ▪ Importance of staking and pruning ▪ Illustration of staking and pruning ▪ Practicing staking and pruning by participants <p>Discussion (10 minutes)</p> <p>After the session, the trainer shall lead trainees in a Q&A session on the issues covered and any other emerging ones</p>	<ul style="list-style-type: none"> ▪ Distribute handouts to participants ▪ Presentation ▪ Demonstration and practice ▪ Q&A sessions
6.7.8 Irrigation using drip and capillary wick methods (30 minutes)	Session guide
<p>Presentation (20 minutes)</p> <ul style="list-style-type: none"> ▪ Description of drip and capillary wick irrigation methods ▪ Benefits of drip and capillary wick irrigation methods ▪ Materials for drip and capillary wick irrigation systems ▪ Installation of drip and capillary wick irrigation methods ▪ Participants practical installation of drip and capillary wick irrigation systems <p>Discussion (10 minutes)</p> <p>After the session, the trainer shall lead participants in a Q&A session on the issues covered and any other emerging ones</p>	<ul style="list-style-type: none"> ▪ Distribute handouts to participants ▪ Presentation ▪ Demonstration and practice ▪ Q &A sessions

6.7.9 Bio-degradable mulching materials for weed management and moisture retention (30 minutes)	Session guide
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> ▪ Description of biodegradable mulching material ▪ Benefits of biodegradable mulching material ▪ Sourcing and installation ▪ Practical installation of biodegradable mulching material <p>Discussion (10 minutes)</p> <p>After the session, the trainer shall lead participants in a Q&A session on the issues covered and any other emerging ones</p>	<ul style="list-style-type: none"> ▪ Distribute handouts to participants ▪ Presentation ▪ Demonstration and practice ▪ Q&A sessions
6.7.10 Model review (10 minutes)	Session guide
<p><i>(The trainer should be able to lead the trainees in reviewing the module)</i></p> <p>Summarize the main points of the training</p> <p>Together with the trainees review the main points in greenhouse tomato production</p> <ul style="list-style-type: none"> ▪ What new things did you learn from this module? ▪ What are some of the problems and issues that you have become more aware of from the module? 	<p>Group discussions</p> <p>Q&A session</p> <ul style="list-style-type: none"> ▪ Recap the main points ▪ Test understanding ▪ Link to the way forward ▪ Participatory evaluation of the session

6.8 Participant's Handouts (Training and Reference Materials)

1. Tomato Production in Green House Manual
2. Greenhouse Tomato Cultivation.Factsheet

References

1. Online manual
2. Production of Greenhouse Tomato—Florida Greenhouse Vegetable Production Handbook, Vol 3 By G. J. Hochmuth
3. Sweet Pepper & Tomato Production Protective Structures By Oscar Salazar
4. <https://homeguides.sfgate.com/grow-plants-coco-peat-22255.html>
5. <https://ypard.net/news/8-mistakes-avoid-tomato-farming-kenya>

MODULE 7

INTEGRATED SOIL AND WATER MANAGEMENT PRACTICES FOR TOMATO PRODUCTION

7.1 Introduction to the module

The performance of the agriculture sector in Kenya has continued to decline over the years due to increased soil acidity, mining of nutrients not supplied in the applied fertilizers, lowering of the soil organic matter content caused by non-use of organic resources. Macronutrients {nitrogen (N), phosphorus (P), potassium (K) and Sulphur (S)} and micronutrients {zinc (Zn), Molybdenum (Mo) and Boron (B)} have been identified as deficient in Kenyan soils. Additionally, climate change has accelerated the decline of the agricultural sector performance through limited and unpredictable water supply to crop production systems. Integrated Soil Fertility Management (ISFM) which includes conservation agriculture offers the best options for improving soil fertility while allowing for climate change adaptation.

Tomato is mostly cultivated by smallholder farmers with minimal inputs. Drought management technologies to mitigate drought effects in the tomato production are available. However, farmers have not realized the full benefits due to limited integration of the developed integrated natural resource management (INRM) and sustainable intensification practices in their tomato production systems. This module introduces service providers, lead farmers and trainers to the importance of integrated soil and water management practices for enhanced tomato production

7.2 Module learning outcomes

By the end of the module, the following training outcomes should be achieved:

1. Knowledge on soil composition, the various physical, chemical and biological properties and what constitutes a healthy soil including soil classification acquired
2. Soil and plant tissue sampling for laboratory analysis, interpretation and utilization of results and also identification of accredited laboratories in Kenya discussed and understood
3. Soil fertility and plant nutrition for increased crop productivity (4R Stewardship that includes nutrient source and application timing and placement methods and timing) understood by the participants
4. Knowledge on soil health and Integrated Soil Fertility Management (ISFM) for climate resilient cropping systems (conservation agriculture, cereal legume intercropping, rotation, organic amendments, manure and composting) acquired
5. Knowledge on water harvesting technologies, soil and water management acquired
6. Knowledge and skills for identifying temporary or permanent decline of land productive capacity and provide various solutions to soil degradation imparted and understood by the participants
7. Awareness on the occurrence of problematic soils and their management increased and understood by the participants

8. Knowledge and skills on drip irrigation technology and its wide application for tomato production and income generation explained and demonstrated.

7.3 Module Target Group and Categories

This module is intended for service providers and county public extension agents in the tomato producing areas.

7.4 Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participants' handouts.

7.5 Module Duration

The Module is estimated to take a minimum of 12 hours.

7.6 Module Summary

Integrated soil and water management practices for tomato production			
Sessions	Training methods	Training materials	Duration
7.6.1 Introduction, objectives and expectations	<ul style="list-style-type: none"> ▪ Personal introductions ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation 	10 minutes
7.6.2 Soil composition, properties and health 7.6.2. Conduct Soil sampling and analysis practical's	Presentations Field demonstrations	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Participants' handouts 	30 minutes
7.6.3 Soil and plant tissue sampling and analysis 7.6.3 Conduct Soil and plant tissue sampling and analysis practical's	Presentations Field demonstrations	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Participants' handouts 	30 minutes
7.6.4. Soil fertility and plant nutrition	Presentations Field demonstrations	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Participants' handouts 	30 minutes

7.6.5 Soil health and ISFM for climate resilient cropping systems	<ul style="list-style-type: none"> ▪ Presentations ▪ Field demonstrations 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Participants' handouts 	30 minutes
7.6.6 Soil degradation and reclamation	<ul style="list-style-type: none"> ▪ Presentations ▪ Field demonstrations 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Participants' handouts 	30 minutes
7.6.8 Problematic soils and their management	<ul style="list-style-type: none"> ▪ Presentations ▪ Field demonstrations 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Participants' handouts 	30 minute
7.7.9 Drip irrigation technology	<ul style="list-style-type: none"> ▪ Presentations ▪ Field demonstrations 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Participants' handouts 	30 minutes
7.7.10 Module review and discussions	<ul style="list-style-type: none"> ▪ Discussions 	<ul style="list-style-type: none"> ▪ Flip charts 	10 minutes
Total			4 hours

7.7 Trainer’s Guidelines

Integrated soil and water management practices for tomato production	
7.7.1. Introduction, objectives and expectations (10 minutes)	Session Guide
<p><i>(The trainer welcomes trainees to the module on sustainable water and soil fertility management practices for sorghum optimal production in moisture stressed conditions. They are then invited to introduce themselves and state their expectations).</i></p> <p>Module Objectives (10 minutes) <i>(The trainer presents modules objectives).</i> By the end of the module the trainee are expected to appreciate:</p> <ul style="list-style-type: none"> • Soil composition, properties and health. • Soil and plant tissue sampling and analysis. • Soil fertility and plant nutrition. • Soil health and ISFM for climate resilient cropping systems. • Soil and water management and water harvesting technologies. • Soil degradation and reclamation. • Problematic soils and their management. • Drip irrigation technology. 	<ul style="list-style-type: none"> • Summarize participants’ “expectations” and display. • PowerPoint presentation • Distribute participants’ handouts on module objectives and training program
7.7.2. Soil composition, properties and health ((30 minutes)	Session Guide
<p><i>(The trainer presents on soil composition, properties and health).</i></p> <p>Plenary Presentation (20 minutes) Soil composition, properties and health</p> <p>Discussion (10 minutes) Let the trainees recall what they learned and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute Participants’ handouts • Brochures, leaflets and manual

7.7.3. Soil and plant tissue sampling and analysis (30 minutes)	Session Guide
<p>Plenary Presentation PowerPoint presentation highlighting the following:</p> <ul style="list-style-type: none"> • Overview of the soil sampling methods • Soil analysis results and interpretation • Overview of soil analysis results using available examples • Soil sampling guidelines <p>Practical exercise on soil sampling Demonstration on soil sampling method</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Brochures, leaflets and manuals • Practical Demonstration
7.7.4. Soil fertility and plant nutrition (30 minutes)	Session Guide
<p>Plenary Presentation PowerPoint Presentation Highlighting:</p> <ul style="list-style-type: none"> • Potential role of different soil managements techniques in addressing soil fertility challenges in sorghum smallholder farming systems • Integrated Soil Fertility Management techniques • Soil management guidelines. <p>Discussion (30 Minutes) Let the trainees recall what they learnt and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Brochures, leaflets and manual
7.7.5 Soil health and ISFM for climate resilient cropping systems (30 minutes)	Session Guide
<p>Plenary Presentation PowerPoint Presentation Highlighting:</p> <ul style="list-style-type: none"> • Soil health • Integrated soil fertility management (ISFM) • Relationship between soil health and ISFM • Manure management, mulching, organic amendments and composting • Conservation agriculture as a climate smart agriculture practice • Relationship between cereal legume intercropping and crop rotation. <p>Discussion (10 minutes) Let the trainees recall what they learnt and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Handouts • Brochures, leaflets and manual

7.7.6 Soil and water management and water harvesting technologies (30 minutes)	Session Guide
<p>Plenary Presentation</p> <ul style="list-style-type: none"> Principles of soil management for increased crop productivity Methods of tillage systems that conserve water for crop use. Introduce the principles of soil fertility management for increased crop productivity Methods of soil fertility management for increased crop productivity. <p>Discussion (10 Minutes) Let the trainees recall what they learnt and discuss any issues that may arise.</p>	<p>Session Guide</p> <ul style="list-style-type: none"> PowerPoint presentation Distribute participants' handouts Brochures, leaflets and manual
7.7.7 Soil degradation and reclamation (30 minutes)	Session Guide
<p>Plenary Presentation</p> <ul style="list-style-type: none"> Overview of soil degradation and reclamation. Causes of soil degradation Reclamation measures of degraded soil Identification of the causes of soil degradation Identification of reclamation measures of degraded soil. <p>Discussion (10 minutes) Let the participants recall what they learnt and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> Session guide PowerPoint presentation Distribute participants' handouts Brochures, leaflets and manual
7.7.8 Problematic soils and their management (30 minutes)	Session Guide
<p>Plenary Presentation</p> <ul style="list-style-type: none"> Problematic soils and their management Soils with unsuitable biological properties Soils with unsuitable chemical properties Soils with unsuitable physical properties. <p>Discussion (10 minutes) Let the trainees recall what they learnt and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> PowerPoint presentation Distribute participants' handouts Brochures, leaflets and manual

7.7.10 Drip irrigation technology (30 minutes)	Session Guide
<p>Plenary Presentation</p> <ul style="list-style-type: none"> • The design parameters used in water supply and distribution • Issues of operation and maintenance • Aspects of water management • Aspects of general crop management • Aspects of fertilizer management • Socio-economic issues. <p>Discussion (10 Minutes) Let the trainees recall what they learnt and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Brochures, leaflets and manual
7.7.11. Module review (10 minutes)	Session Guide
<p><i>(The trainer leads the trainees in reviewing the module).</i></p> <p>Summarize the main points of the training and together with the participants review the main points.</p> <p><i>(Discuss with trainees about new things learnt from this Module. What are some of the problems and issues that they have become more aware of in the module?)</i></p>	<ul style="list-style-type: none"> • Distribute participants' handouts • Summary of the main points from the module on a flip chart and display

7.8 Participants' Hand outs

1. Soil Fertility and Water Management Technologies for Tomato Production. Factsheets. 2019
2. Leaflets [KCEP-CRAL Manual, 2019]

References

1. Soil Management Extension Manual [KCEP-CRAL Manual 2019]
2. Soil Management Leaflets [KCEP-CRAL PAMHPLETS 2019]
3. OFRA Technical Training Manual

MODULE 8

PEST MANAGEMENT IN TOMATO

8.1. Introduction to the Module

Tomato is widely grown by a large number of smallholder farmers in Kenya as an important horticultural cash crop. It is either grown for processing or for fresh market. The crop can either be produced under rain-fed or irrigation in the open field or under faces greenhouse. However, tomato production a lot of challenges, including incidences of pest infestations. Tomato is affected by a wide range of pests right from the nursery up to the field. The high temperatures and humidity that is being experienced in many parts of the country, especially in the arid and semi-arid areas, creates a conducive environment for faster multiplication of pests. This is aggravated further by the emerging adverse effects of climate change. In addition, the pests have very short life cycles in their stages of development from the egg to adult. Some pests have the ability to produce over 500 eggs per adult which develop into full adults within 3-4 days. These high populations of pests are a threat to tomato farming if control measures are not undertaken. This module is therefore meant to help the ToTs have an understanding of the different types of pests and their management practices.

8.2. Module Learning Outcomes

By the end of the module, the following outcomes must be achieved:

- Insect pests and their economic importance described and appreciated
- Scouting skills on developed
- Different kinds of tomato pests identified
- Ways of controlling different types of tomato pests discussed and appreciated
- Adequate skills on integrated pest management acquired
- Skills to minimize tomato crop damage by pests learnt

8.3. Module Target Group

This module targets all agricultural extension officers, tomato nursery operators and all private tomato service providers in the counties.

8.4. Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participant's handouts.

8.5. Module Duration

The module is estimated to take a minimum of 4 hours.

8.6. Module Summary

Pest management in tomato			
Sessions	Training Methods	Training Materials	Time
8.6.1 Introduction and climate setting, objectives and expectations	<ul style="list-style-type: none"> ▪ Personal introductions ▪ Presentations 	<ul style="list-style-type: none"> ▪ PowerPoint ▪ Sticky leaf pads ▪ Felt pens ▪ Program 	10 minutes
8.6.2 Terminologies used in pest management and their economic importance	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	20 minutes
8.6.3 Scouting and how to undertake scouting in a tomato field	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	30 minutes
8.6.4 Identification of the different tomato pests and their mode of destruction	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions ▪ Practical demonstrations in identification of tomato pests under nursery and field conditions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	1 hour
8.6.5 Management options for the different tomato pests	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions ▪ Practical demonstrations in identification of tomato pests under nursery and field conditions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	40 minutes
8.6.6 Module review	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ flip charts ▪ PowerPoint ▪ Handouts 	10 minutes
TOTAL			3 hours

8.7.2 Terminologies used in pest management and their economic importance (20 minutes)	Session guide
<p><i>(The trainer should describe the main terminologies used in pest management)</i></p> <ul style="list-style-type: none"> ▪ Definition of a pest ▪ Scouting ▪ Pesticides ▪ Integrated pest management ▪ Pheromones ▪ Traps ▪ Plant extracts ▪ Biological control ▪ Cultural control <p>Discussion</p> <p>After the lecture session, the trainer will allow trainees to recall what they learnt and discuss emerging issues</p>	<p>Distribute handouts to participants on</p> <p>Terminologies used in pest management</p>
8.7.3 Scouting and how to undertake scouting in a tomato field. (30 minutes)	Session guide
<p><i>Present the following on PowerPoint slides and flip charts:</i></p> <ul style="list-style-type: none"> ▪ Scouting and its importance ▪ Steps undertaken in scouting ▪ Methods of scouting ▪ Decisions to be undertaken after scouting. <p>Discussion</p> <p>After the presentation, guide the trainees to recall what they learnt and discuss issues that may arise.</p>	<p>Distribute handouts to participants</p> <ul style="list-style-type: none"> • Scouting protocol, poster, brochures and leaflets <p>Discuss the task in groups and come with a presentation for plenary discussions/ inputs</p> <p>Q&A sessions</p>

8.7.4 Identification of the different kinds of tomato pests in a field and their mode of destruction (1 hour)	Session guide
<p><i>Trainer takes the trainees to the tomato field and show them how to identify the different kinds of pests and the kind of damages they cause to tomato</i></p> <ul style="list-style-type: none"> ▪ Use of nets to catch insect pests ▪ Identify the pests caught ▪ Identify the plant parts that the different kinds of pests like to attack ▪ Identify the life cycle stage of the pest which is more destructive to the tomato plant and fruits. <p>Discussion</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<p>Distribute handouts to participants</p> <ul style="list-style-type: none"> ▪ Manuals different kinds of pests and the damages they cause ▪ Brochures ▪ Posters ▪ Leaflets
8.7.5 Control measures for different tomato pests (40 minutes)	Session guide
<p><i>(The trainer should be able to lead the trainees in understanding the control measures that are available for pest management in tomato).</i></p> <ul style="list-style-type: none"> • Types of pesticides and the types of insects they are used to control • Cultural control methods • Natural enemies • Biological control • Traps • Pheromones • Methods to spray pesticides on tomato. <p>Discussion</p> <p>After the presentations allow trainees to raise any issues and discuss them</p>	<p>Distribute handouts to participants</p> <ul style="list-style-type: none"> ▪ Manuals of different kinds of pest control practices ▪ Brochures ▪ Posters ▪ Leaflets

8.7.6 Module review (10 minutes)	Session guide
<p><i>(The trainer to lead the trainees in reviewing the module).</i></p> <p>Summarize the main points of the training together with the trainees and review the main points about pest management in tomato</p> <ul style="list-style-type: none"> ▪ What new things did you learn from this module? ▪ What are some of the problems and issues that you have become more aware of from the module? 	<p>Group discussions</p> <p>Q&A session</p> <ul style="list-style-type: none"> ▪ Recap the main points ▪ Test understanding ▪ Link to the way forward ▪ Participatory evaluation of the session

8.8 Participant's Handouts (Training and Reference Materials)

Handouts

1. Tomato pests.
2. Fact Sheets

References

1. Terminologies used in Pest Management
2. Scouting protocol
3. Different kinds of pests and the damages they cause
4. Different kinds of pest control practices
5. IPM and its practices
6. Tomato Production Manual

MODULE 9

TOMATO DISEASES AND THEIR MANAGEMENT

9.1 Introduction to the Module

Tomato is one of the most important crops in Kenya with high market demand for quality fruits and their value added products. However, tomato production faces serious challenges due to numerous pests and pathogens leading to reduced yield, quality, and increased costs of production. Heavy use of synthetic chemical pesticides in tomato production is an issue of major concern in food safety, and is also a risk to human health and pollution of the environment. To enhance production of high quality tomato, there are several methods available that can be utilized to control diseases. These include resistant cultivars, biological control, cultural practices, judicious use of pesticides and manipulation of environmental conditions. This module describes the major diseases constraining tomato production, their symptoms and impacts, and control measures.

9.2 Module Learning Outcomes

By the end of the module, the following outcomes should be achieved:

- Major fungal, bacterial, viral diseases and nematodes of tomato identified.
- Key symptoms for disease diagnosis described.
- Effective field scouting plan for the major tomato diseases designed.
- Effective disease management plan designed and implemented.
- Use and/or sale disease free tomato seed and seedlings discussed and appreciated
- Inappropriate use of synthetic chemical pesticides to enhance quality and safety of tomato fruit discussed and appreciated.
- Extension/ training program on tomato diseases and their management designed and implemented.

9.3 Module Target Group

This module targets all horticulture extension officers, commercial tomato nursery operators and private seed producers countrywide.

9.4 Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participants' handouts.

9.5 Module Duration

The module is estimated to take approximately 3 hours.

9.6 Module Summary

Tomato diseases and their Management			
Sessions	Training Methods	Training Materials	Time
9.6.1 Introduction, objectives and expectations	<ul style="list-style-type: none"> ▪ Personal introductions ▪ Presentations 	<ul style="list-style-type: none"> ▪ PowerPoint 	10 minutes
9.6.2 The impact of diseases on tomato production (yield losses, quality issues, costs, etc.)	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Videos 	30 minutes
9.6.3 Fungal, bacterial and viral diseases, nematodes and physiological disorders of economic importance in tomato	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions ▪ Practical demonstrations 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts ▪ Plant specimens ▪ Pathogen cultures ▪ Videos 	30 minutes
9.6.4 Analyses of the critical factors in disease occurrence and management	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	30 minutes
9.6.5 Management of tomato diseases	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	40 minutes
9.6.6 Pesticides application and safe use	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	30 minutes
9.6.7 Module review	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ flip charts ▪ PowerPoint ▪ Handouts 	10 minutes
TOTAL			3 hours

9.7.2 The impact of diseases on tomato production (30 minutes)	Session guide
<p><i>(The trainer leads in describing the impact of diseases on tomato production and issues in their management)</i></p> <p>Plenary Presentation</p> <ul style="list-style-type: none"> ▪ Yield losses ▪ Quality reduction ▪ Pesticides and food safety challenges ▪ Costs (financial, environmental, health) <p>Discussion</p> <p>After the practical demonstration, the trainer will allow trainees to recall what they learnt and discuss their own experiences and other emerging issues</p>	<p>Distribute handouts to participants on tomato production trends, disease events, damages/losses</p>

9.7.3 Fungal, bacterial and viral diseases, nematodes and physiological disorders of economic importance in tomato (30 minutes)	Session guide
<p>Plenary Presentation</p> <ul style="list-style-type: none"> ▪ Symptoms of different major fungal diseases ▪ Methods of diagnosis ▪ Damage and losses caused ▪ Forecasting and detection ▪ Management methods <p><i>Show videos on fungal tomato diseases, and discuss the content e.g.</i></p> <p>https://www.youtube.com/watch?v=ckb0yZO9VrY</p> <p>https://www.youtube.com/watch?v=z3UcWu-p-CU</p> <p>https://www.youtube.com/watch?v=vKWcKMCXuqY</p> <p>https://www.youtube.com/watch?v=pw_LeWTnwDM</p> <p>https://www.youtube.com/watch?v=pw_LeWTnwDM</p> <p>https://extension.psu.edu/scouting-and-identifying-tomato-diseases</p> <p>https://www.youtube.com/watch?v=-KTdzdFuPL8</p> <p>https://www.youtube.com/watch?v=E5N4e053ExQ</p> <p>https://www.youtube.com/watch?v=pw_LeWTnwDM</p> <p><i>Visit laboratory</i> for trainees to view pathogen cultures and specimens of diseased tomato plants, plant tissues or fruits. (2 hours)</p> <p><i>Visit greenhouse</i> or field demonstration site for trainees to view the diseased plants at different stages of growth and infection stages.</p> <p><i>Demonstrate management</i> measures for fungal diseases using some of the plants in the greenhouse or field site. (1 hour)</p> <p>Discussion (10 minutes)</p> <p>After the presentation, guide the trainees to recall what they learnt and observed and discuss issues that may arise.</p>	<p>Distribute handouts and photocard to participants on fungal tomato diseases</p> <p>Arrange 1-2 days before training to collect tomato plants infected with various pathogens (leaves, fruits, roots) to view in the laboratory</p> <p>Arrange 1 week before training to initiate cultures of different fungal pathogens of tomato.</p> <p>Plant tomato plants (mix susceptible / tolerant cultivars) 1-3 months before training and leave to be naturally infected with various fungal pathogens in greenhouse (can inoculate artificially)</p> <p>Q &A sessions</p>

<p><i>(The trainer describes and analyzes the critical factors in disease occurrence and management).</i></p> <p>Plenary Presentation</p> <ul style="list-style-type: none"> ▪ Host varieties ▪ Environmental conditions (humidity, temperature, pH, etc.) ▪ Human influence/activities <p>Discussion</p> <p>After the presentation, the trainer will allow trainees to recall what they learnt and discuss their own observations and other emerging issues.</p>	<p>Distribute handouts to participants on the critical factors in plant disease occurrence and their management</p>
9.7.5 Management of tomato diseases (40 minutes)	
<p><i>(The trainer describes the different methods for managing pathogens and diseases (30 minutes)</i></p> <p>Plenary Presentation</p> <ul style="list-style-type: none"> ▪ Quarantine ▪ Cultural practices ▪ Biological control ▪ Vector control ▪ Physical methods (heating, irradiation, filtration) ▪ Resistant varieties ▪ Exclusion, prevention and eradication concepts ▪ Application of agro-pesticides ▪ Integrated pest management (IPM) options <p>Discussion (10 minutes)</p> <p>After the presentation, the trainer will allow trainees to recall what they learnt and discuss their own experiences, observations and other emerging issues.</p>	<p>Distribute handouts to participants on the methods of tomato diseases management</p>

9.7.6 Pesticide application and safe use (30 minutes)	
<p><i>Present the following on PowerPoint slides and flip charts: (20 minutes).</i></p> <ul style="list-style-type: none"> ▪ Pictures of different pesticides ▪ Pictures of application equipment ▪ Images of damage due to pesticide misuse ▪ Application methods ▪ Storage methods <p><i>(Show video on nematodes on tomato, and discuss the content (30 minutes).</i></p> <p>https://www.youtube.com/watch?v=E5N4e053ExQ</p> <p>https://www.youtube.com/watch?v=pw_LeWTnwDM</p> <p>Visit pesticide stores for trainees to view details of different chemicals and discussion (10 minutes)</p> <p>After the visit, guide the trainees to recall what they learnt and observed and discuss issues that may arise.</p>	<p>Distribute handouts and photocard to participants on pesticides</p> <p>Arrange 1-2 days before training to collect tomato pesticide containers</p>
9.7.7 Module review (10 minutes)	Session guide
<p><i>(The trainer should be able to lead the trainees in reviewing the module).</i></p> <p>Summarize the main points of the training.</p> <p>Together with the trainees review the main points about tomato diseases, their diagnosis and management methods.</p> <ul style="list-style-type: none"> ▪ What new things did you learn from this module? ▪ Which group of pathogens pose the most serious threat to tomato production? ▪ What are some of the problems and issues that you have become more aware of in the module? ▪ Which new topics/sessions can be added to enrich the module? 	<p>Group discussions</p> <p>Q&A session</p> <ul style="list-style-type: none"> ▪ Recap the main points ▪ Test understanding ▪ Link to the way forward ▪ Participatory evaluation of the session

9.8 Participant's Handouts

1. Tomato Diseases and Management
2. Factsheets

References

- 1 Tomato Anna F1 Growers Handbook. http://www.monsantoafrica.com/_pdfs/tomato_anna_f1_growers_handbook.pdfk.pdf
- 2 Tomato – Infonet-Biovision. <https://www.infonet-biovision.org/PlantHealth/Crops/Tomato>
- 3 Mistakes to avoid in tomato farming in Kenya. <https://ypard.net/news/8-mistakes-avoid-tomato-farming-kenya>

MODULE 10

WEEDS MANAGEMENT IN TOMATO

10.1 Introduction to the Module

Tomato is widely grown by a large number of smallholder farmers in Kenya as an important horticultural cash crop. It is either grown for processing or for fresh market. The crop can either be produced under rain-fed or irrigation in the open field or under greenhouse. It is rich in Vitamin C. However, tomato production has a lot of challenges including occurrence of weeds. Tomato is a crop whose fields become infested by a wide range of weeds from the nursery up to the field. Weeds are undesirable plants growing amidst tomato where they present competition for growth and development resources needed by the tomato crop i.e. moisture, nutrients, light and space. Those in the Solanacea family also provide cover for tomato pests like aphids, whitefly, red spider mites, etc. or act as alternate hosts for diseases such as bacterial wilt and fungal blights. Some may also cause allelopathic effect (these are toxins which adversely affect crop growth) while those that grow faster than tomato may cause elongated internodes hence yield reduction. This module is therefore meant to help the master trainers have an understanding of the different types of weeds and their management practices.

10.2 Module Learning Outcomes

By the end of the module, the following outcomes should be achieved:

- Weeds and their economic importance described
- Different kinds of tomato weeds identified
- Distinct ways of controlling different types of weeds that occur in tomato discussed and appreciated
- Adequate skills on integrated weeds management (IWM) developed.

10.3 Module Target Group

This module targets all agricultural extension officers, tomato nursery operators and all private tomato service providers countrywide.

10.4 Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participants' handouts.

10.5 Module Duration

The module is estimated to take a minimum of 3 hours.

10.6 Module Summary

Weed management in tomato			
Sessions	Training Methods	Training Materials	Time
10.6.1 Introduction and climate setting, objectives and expectations	<ul style="list-style-type: none"> ▪ Personal introductions ▪ Presentations 	<ul style="list-style-type: none"> ▪ PowerPoint ▪ Sticky leaf pads ▪ Felt pens ▪ Program 	15 minutes
10.6.2 Analyses of critical factors in weed occurrence, their management and impact on tomato production	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint Handouts 	30 minutes
10.6.4 Identification of the different weeds of economic importance in tomato Broad leaf, grasses, sedges and parasitic weeds, and their mode of destruction	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions ▪ Practical demonstrations in identification of tomato pests in a nursery and in the field 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	1 hour
10.6.5 Management options for the different weeds that occur in tomato fields	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions ▪ Practical demonstrations in identification of weeds in tomato in a nursery and in the field 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint ▪ Handouts 	1 hour
10.6.6 Module review	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint ▪ Handouts 	15 minutes
TOTAL			3 hours

10.7.3 Identification of weeds of economic importance that occur in tomato crop grown in the fields and in greenhouses, broad leaved, grasses, sedges and parasitic weeds (1 hour)	Session guide
<p>Plenary Presentation</p> <ul style="list-style-type: none"> ▪ Biological (type: broad leaf, sedge or grass; plant parts: flowers, stems and leaves; growth pattern: annual or perennial) characteristics of weeds of economic importance ▪ Methods of identifying them ▪ Damage and losses caused <p><i>Show photo/video on weeds, and discuss the content.</i></p> <p><i>Visit greenhouse for trainees to view weeds of tomato plants or field site and control measures. (1hours)</i></p> <p>Discussion</p> <p>After the presentation, guide the trainees to recall what they learned and observed and discuss issues that may arise.</p>	<p>Distribute handouts and photo card to participants on tomato weeds</p> <p>Arrange 1-2 days before training to take photos or assemble pictures of tomato.</p> <p>Arrange 1 day training to collect weeds before training and characterize them with participant to create awareness.</p> <p>Q&A sessions</p>
10.7.4 Management of weeds that infest tomato crop (1 hour)	
<p>Plenary Presentation</p> <p>Management methods</p> <p>Mechanical</p> <ul style="list-style-type: none"> ▪ Exclusion, prevention ▪ Cultural practices ▪ Biological control ▪ Resistant varieties ▪ Herbicides ▪ Integrated weed management (IWM); using most appropriate, case specific, combination of strategies <p>Discussion</p> <p>After the presentation, guide the trainees to recall what they learnt and observed and discuss issues that may arise.</p>	<p>Distribute handouts and photo card to participants on parasitic weed infestation</p> <p>Arrange 1-2 days before training to collect information on tomato plants infested with parasitic weeds.</p> <p>Q&A sessions</p>

10.7.5 Module review (15 minutes)	Session guide
<p><i>(The trainer should be able to lead the trainees in reviewing the module).</i></p> <p>Summarize the main points of the training.</p> <p>Together with the trainees review the main points on weeds, their identification, and management methods.</p> <ul style="list-style-type: none"> ▪ What new things did you learn from this module? ▪ Which groups of weeds pose the most serious threat to tomato production? ▪ What are some of the problems and issues that you have become more aware of in the module? ▪ Which new topics/ sessions can be added to enrich the module? 	<p>Group discussions</p> <p>Q&A session</p> <ul style="list-style-type: none"> ▪ Recap the main points ▪ Test understanding ▪ Link to the way forward ▪ Participatory evaluation of the session

10.8 Participant’s Handouts (Training and Reference Materials)

KALRO (2019). Weed Management in Tomato. 8 factsheets

MODULE 11

TOMATO HARVESTING AND POST-HARVEST MANAGEMENT

11.1 Introduction to Module

This module is designed for Master Trainers in skills that are useful in handling tomato during harvesting and postharvest. Tomato destined for various markets and end use should be harvested at the appropriate time. This ensures good quality of produce with extended shelf-life. Tomato can be harvested in either matured green, partially ripe, or ripe state. Many farmers especially new entrants into the market are not very familiar with the maturity indices for tomato. In tomato producing areas, farmers engage unskilled labour in harvesting tomato. The harvesting and packaging containers used by farmers may be inappropriate in some cases. Tomato are delicate fruits, bulky, highly perishable and easily deteriorate in quality if not handled properly after harvesting, leading to between 30-50 per cent postharvest losses. Careful handling of tomato from harvesting up to market ensures 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 harvesting and postharvest handling of tomato and capacity build them on best practices that include determination of maturity indices, fruit harvesting technique, appropriate harvesting and holding containers, sorting and grading, precooling at farm level, packaging, transportation and postharvest diseases management.

11.2 Module Learning Outcomes

By the end of the module the following outcomes should be achieved:

- The maturity indices for tomato fruits destined for various markets identified
- Quality attributes of tomato that need to be preserved during postharvest handling identified
- Appropriate harvesting technique and harvesting containers for tomato fruit explained and demonstrated
- Postharvest practices for tomato from harvesting to marketing explained
- Use of the low cost cooling units (charcoal cooler and zero energy cooler) at farm level explored and evaluated.

11.3 Module Target

This module targets Service Providers and County Public Extension staff involved in tomato value chain.

11.4 Module Users

The module users are the Master Trainers (ToTs) / Core Training Team (CTT).

11.5 Module Duration

The module is estimated to take 2 hours.

11.6 Module Summary

TOMATO HARVESTING AND POST HARVEST MANAGEMENT			
Sessions	Training Methods	Training Materials	Time
1. Introductions and levelling of expectations	<ul style="list-style-type: none"> ▪ Presentation ▪ Plenary discussion 	<ul style="list-style-type: none"> ▪ Flip charts, pens masking tapes, flush cards ▪ Module objectives 	10 minutes
2. Introduction to Tomato postharvest handling	<ul style="list-style-type: none"> ▪ Presentation ▪ Plenary discussion 	<ul style="list-style-type: none"> ▪ PowerPoint presentations and discussions 	40 minutes
3. Maturity indices and harvesting	<ul style="list-style-type: none"> ▪ Presentation ▪ Group exercise ▪ Group presentations 	<ul style="list-style-type: none"> ▪ PowerPoint ▪ Charts ▪ Participants' handouts ▪ Flip charts, pens, ▪ Flash cards of different colours, cutters ▪ Presentations 	30 minutes
4. Tomato postharvest handling practices	<ul style="list-style-type: none"> ▪ Presentation ▪ Group exercise ▪ Group presentations 	<ul style="list-style-type: none"> ▪ PowerPoint presentation ▪ Charts ▪ Participants' handouts ▪ Flip charts, pens, 	30 minutes
5. Module review	<ul style="list-style-type: none"> ▪ Participants' questions and comments ▪ Trainer's summary 	<ul style="list-style-type: none"> ▪ Module review ▪ A small ball for throwing 	10 minutes
TOTAL			2 hours

11.7 Trainers Guidelines

11.7.1 Introduction And Levelling Of Expectation (10 Minutes)	Session Guide
<p>Introduction</p> <p><i>(The trainer welcomes the trainees to the module tomato harvesting and postharvest management and introduces him/her by stating his profile and experience of working with farmers).</i></p> <p>The trainer invites the trainees to state their expectations.</p> <p>Module Objectives</p> <p>By the end of the module the trainee should be able to:</p> <ul style="list-style-type: none"> ▪ Identify the maturity indices for tomato fruits destined for various markets ▪ Identify quality attributes of tomato that need to be preserved during postharvest handling ▪ Explain how to apply appropriate harvesting techniques for tomato fruit ▪ Explain how to apply appropriate tomato postharvest handling practices to maintain quality ▪ Explain how to apply appropriate postharvest practices to reduce postharvest diseases infestation 	<p>Distribute</p> <p>Participants' handouts</p> <p>Module objectives, discussing each in light of the participants' expectations.</p>
10.7.2 Introduction to tomato postharvest handling (40 minutes)	
<p><i>The trainer guides a discussion on the definition of postharvest handling, explain the importance of postharvest handling and identify quality attributes of tomato (40 minutes).</i></p> <p>Plenary Presentation/Discussion</p> <ul style="list-style-type: none"> ▪ Postharvest handling ▪ Importance of appropriate postharvest handling ▪ Quality attributes of tomato fruit ▪ Causes of postharvest losses 	<ul style="list-style-type: none"> • PowerPoint presentations • Distribute to participants' Handouts on introduction to tomato postharvest handling

10.7.3 Tomato Maturity indices and harvesting (30 minutes)	Session Guide
<p><i>The trainer should guide a discussion on the definition of maturity indices identify maturity indices and describe appropriate harvesting techniques (40 minutes).</i></p> <p>Plenary Presentation</p> <ul style="list-style-type: none"> • Maturity indices • Stages of maturity • Physical and chemical types of maturity indices: • Importance of applying correct maturity indices • Different methods of harvesting 	<ul style="list-style-type: none"> • PowerPoint presentations • Tomato samples indicating different maturity indices • Distribute Participants' Handouts on Tomato maturity and harvesting
10.7.4 Tomato postharvest handling practices (30 minutes)	Session Guide
<p><i>(The trainer should guide a participatory discussion on appropriate postharvest handling practices (1hr 30minutes).</i></p> <p>Plenary Presentation/Discussion</p> <p>Explain:</p> <ul style="list-style-type: none"> • Importance and process of sorting and grading • The function of cooling at farm level (Charcoal and Zero-Energy coolers (ZEC)) • Proper packaging (plastic crates) • Appropriate mode of transportation. <p>Lead the trainees in a participatory discussion on these processes.</p>	<ul style="list-style-type: none"> • PowerPoint presentations • Distribute Participants' Handouts on Tomato handling
10.7.5 Module review (10 minutes)	Session Guide
<p><i>(The trainer asks the trainees to present their views on each of the aspects in tomato, maturity indices, harvesting and postharvest handling practices and summarize the key points they should emphasize when training farmers making reference to the opportunities mentioned earlier (20 minutes).</i></p> <ul style="list-style-type: none"> • What new things did you learn from this module? • What are some of the problems and issues that you have become more aware of in tomato harvesting and postharvest management? • What questions do you still have about harvesting and postharvest management? • Who can explain the first point-the message and its application? The second message? The third message? And so on. 	<p>Group discussions</p> <p>Q&A session</p> <ul style="list-style-type: none"> ▪ Recap the main points ▪ Test understanding ▪ Link to the way forward <p>Participatory evaluation of the session</p>

11.8 Participant's Handouts

1. Maturity indices in tomato. Factsheet
2. Tomato harvesting and handling. Factsheet

References

1. KALRO/USAID (2017). Greenhouse Tomato Production Manual

MODULE 12

TOMATO PROCESSING

12.1 Introduction to the Module

This module is designed for training trainers to get skills that are useful in adding value to tomato after harvesting. Tomato fruit is highly perishable resulting in high 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, this increases their economic value thus giving better returns to farmer or various value chain actors.

Processing diversifies markets and utilization of tomato. If adequate plans have not been made for preservation, farmers will dispose-off what they produce immediately after harvesting reducing incomes and affecting future production plans. There are opportunities in earning more income through value addition. Expertise and skills in tomato processing is lacking or information available at grass-roots level is limited. Farmers invest very little effort in value addition due to a number of reasons. Even where development agencies have supported value adding activities in tomato, effective marketing strategies are not in place. The groups do not have the organizational structures to execute value addition strategies if any exist. It is common to find the producer groups' executive committee members marketing processed products during exhibitions, field days and shows instead of engaging workers on commission to market their produce. Where processing facilities have been provided by projects or development agents, rarely are marketing plans and operations and maintenance procedures developed and in place. Majority of value chain actors lack knowledge in organizational development of value addition processes and also face capacity and infrastructural constraints. This limits value addition enterprise development and hence is not sustainable neither can it lead to enterprise growth. There is need for capacity building to address these challenges and promote tomato processing at cottage industry level as viable commercial enterprises.

12.2 Module Learning Outcomes

By the end of the module the following outcomes should be achieved:

- Quality attributes of tomato that are important for processing identified
- Processing opportunities in tomato value chain identified and prioritized
- Value addition practices on tomato pulp and dehydration of tomato explained.

12.3 Module Target

This module targets Service Providers and County Public Extension staff.

12.4 Module Users

The Module users are Master Trainers (ToTs)/ Core Training Team.

12.5 Module Duration

The Module is estimated to take 2 hours.

12.6 Model Summary

Tomato processing			
Sessions	Training Methods	Training Materials	Time
1. Introductions and levelling of expectations	<ul style="list-style-type: none"> ▪ Presentation ▪ Discussion 	<ul style="list-style-type: none"> ▪ Flip charts, pens, masking tapes, flush cards ▪ Module objectives 	10 minutes
2. Introduction to Tomato processing	<ul style="list-style-type: none"> ▪ Presentations ▪ Group exercise ▪ Group presentations 	<ul style="list-style-type: none"> ▪ PowerPoint presentations and discussions ▪ Participants' handouts ▪ Flip charts, pens, flash cards of different colours, cutters ▪ Presentations 	20 minutes
4. Prioritizing opportunities in tomato processing	<ul style="list-style-type: none"> ▪ Presentations and discussions ▪ Group exercise / ranking ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ List of products developed in sessions 2 above ▪ Checklist for prioritization ▪ Flip charts 	20 minutes
5. Processing of tomato into pulp	<ul style="list-style-type: none"> ▪ Presentation ▪ Focused group discussion ▪ Plenary presentation 	<ul style="list-style-type: none"> ▪ Projector ▪ Flip charts ▪ Participants' handouts (sample charts) 	30 minutes
6. Use of solar dryer to dehydrate tomato	<ul style="list-style-type: none"> ▪ Presentation ▪ Focused group discussion ▪ Plenary presentation 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Participants' handouts (sample charts) 	30 minutes

7. Module review	<ul style="list-style-type: none"> ▪ Participants' questions and comments ▪ Trainer's summary 	<ul style="list-style-type: none"> ▪ Module review 	10 minutes
TOTAL			2 hours

12.7 Trainers Guidelines

12.7.1 Introduction and levelling of expectation (10 Minutes)	Session Guide
<p><i>(Trainer welcomes trainees to the module tomato value addition methodology and introduces him/her by stating his profile and experience of working with farmers).</i></p> <p><i>The trainer invites the trainees to state their expectations.</i></p> <p>Module Objectives</p> <p>The trainer presents modules objectives.</p> <p>By the end of the module training the trainee should be able to:</p> <ul style="list-style-type: none"> • Identify quality attributes of tomato that are important for value addition. • Identify and prioritize value addition opportunities in tomato value chain • Explain value addition practices on tomato pulp and dehydration of tomato • Carry out processing of tomato into pulp and dehydration of tomato using solar drier 	<p>Distribute participants' Handouts, module objectives, discussing each in light of the participants' expectations.</p>
Introduction to tomato processing (20 minutes)	Session Guide
<p><i>(The trainer guides a discussion on the definition of value addition, tomato value addition processes, and benefits of processing and the range of products).</i></p> <p>Plenary Presentation</p> <ul style="list-style-type: none"> • Benefits processing of tomato • Requirements of processing in tomato 	<p>PowerPoint presentation</p> <p>Participants' hand-outs</p>

3. Processing of tomato into pulp and use of drier to dehydrate tomato (1 hr 40 minutes)	Session Guide
<p><i>(Trainer leads trainees an d practical activity which attributes of processing are shown)</i></p> <p>Practical Demonstration</p> <ul style="list-style-type: none"> • Processing of tomato into pulp • The protocol on use of drier to dehydrate tomato 	<p>Practical on processing of tomato into pulp</p> <p>Practical on tomato solar drying</p> <p>Handouts on processing of tomato into pulp and solar drying</p>
;6. Module Review (20minutes)	Session Guide
<p>Trainer leads trainees in reviewing the main points about Tomato value addition</p> <ul style="list-style-type: none"> · What new things did you learn from this module? · What are some of the problems and issues that you have become more aware of in processing? · What questions do you still have about processing? 	<p>Distribute participants' Handouts</p> <p>The trainer reviews the lesson learnt to participants' at random</p>

12.8 Participant's Handouts

1. KALRO Tomato processing factsheet

References

KALRO/USAID (2017). Greenhouse Tomato Production Manual

MODULE 13

MECHANIZATION OF TOMATO PRODUCTION ACTIVITIES

13.1 Introduction to the module

Agricultural mechanization supports in enhancing production, productivity and profitability in agriculture by achieving timeliness in farm operations. It also comes along with precision in measurement and placement of inputs, reducing available input losses, increasing utilization efficiency of costly inputs (seed, chemical, fertilizer, irrigation, water etc.), reducing unit cost of produce, enhancing profitability and competitiveness in the cost of operation. It also helps in the conservation of agricultural produce and byproducts from qualitative and quantitative damages; enables value addition and establishment of agro processing enterprises for additional income and employment generation. Agricultural mechanization is one of the important inputs that has potential to revolutionize all round development in the rural Kenya.

13.2 Module learning outcomes

By the end of the module section the following outcomes should be achieved:

- Climate smart tillage options explored and explained
- Seedbed preparation tools explained
- Roof water harvesting (greenhouse) demonstrated
- Calibration of fertilizer and seed rates for planters explained
- Use of pest control implements and tools demonstrated
- Machine and procedure for tomato grading demonstrated and explained.

13.3 Module Target Group and Categories

This module is intended for service providers and county public extension agents.

13.4 Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participant's handouts.

13.5 Module Duration

The module is estimated to take a minimum of 2 hours.

13.6 Module Summary

Module 13.6 Mechanization of tomato production activities			
Sessions	Training methods	Training materials	Duration
Introduction, objectives and expectations	<ul style="list-style-type: none"> • Personal introductions/ know your audience • Presentations • Plenary discussions 	<ul style="list-style-type: none"> • Flip charts • PowerPoint Presentations 	10 minutes
Climate smart tillage options	<ul style="list-style-type: none"> • Presentations • Plenary discussions 	<ul style="list-style-type: none"> • Flip chart • PowerPoint presentation • Participants' Handouts 	15 Min
Seedbed preparation tools	<ul style="list-style-type: none"> • Presentations • Plenary discussions 	<ul style="list-style-type: none"> • Flip chart • PowerPoint presentation • Participants' Handouts 	20 Min
Roof water harvesting (greenhouse)	<ul style="list-style-type: none"> • Presentations • Plenary discussions 	<ul style="list-style-type: none"> • Flip charts • PowerPoint presentation • Participants' Handouts • Practical 	15 minutes
Calibration of fertilizer and seed rates for planters	<ul style="list-style-type: none"> • Presentations • Plenary discussions 	<ul style="list-style-type: none"> • Flip chart • PowerPoint presentation • Participants' Handouts • Practical 	20 minutes
Use of pest control implements and tools	<ul style="list-style-type: none"> • Presentations • Plenary discussions 	<ul style="list-style-type: none"> • Flip chart • PowerPoint presentation • Participants' Handouts • Practical 	20 minutes

Machine and procedure for tomato grading	<ul style="list-style-type: none"> • Presentations • Plenary discussions • Demonstrations 	<ul style="list-style-type: none"> • Flip chart • PowerPoint presentation • Participants' Handouts • Practical 	10 minutes
Module review	<ul style="list-style-type: none"> • Participants' questions and comments • Trainer's summary 	<ul style="list-style-type: none"> • Module review 	10 minutes
Total			2 hours

13.7 Trainer's Guidelines

Module 13: Mechanization of Tomato production activities	
13.7.1 Introduction, Objectives and Expectations (10 minutes)	Session Guide
<p><i>(The trainer welcomes trainees to the module on mechanization of tomato production activities that help reduce the drudgery. They are then invited to introduce themselves and state their expectations).</i></p> <p>Module Objectives (10 minutes) <i>(The trainer presents modules objectives).</i></p> <p>By the end of the module the trainee is expected to:</p> <ul style="list-style-type: none"> • Explore various climate smart tillage operations. • Appreciate climate smart tillage options. • Appreciate seedbed preparation tools. • Demonstrate roof water harvesting (greenhouse). • Appreciate calibration of fertilizer and seed rates for planters. • Demonstrate use of pest control implements and tools. • Appreciate machine and procedure for tomato grading. 	<ul style="list-style-type: none"> • Summarize trainees' Expectations and display. • PowerPoint Presentation • Distribute participants' Handouts on module objectives and training program

13.7.2 Tomato climate smart tillage options (15 minutes)	Session Guide
<p><i>(The trainer presents on the commonly known tomato land preparation options that are of economic importance)</i></p> <p>Plenary Presentation)</p> <ul style="list-style-type: none"> • Overview of the tomato mechanization activities • Climate smart tillage options <p>Discussion Let the participants recall what they learned and discuss any issues that may arise</p>	<ul style="list-style-type: none"> • PowerPoint Presentation • Distribute participants' Handouts • Brochures, leaflets and manual • All participants
13.7.3 Seedbed preparation tools (20 minutes)	Session Guide
<p>Plenary Presentation</p> <ul style="list-style-type: none"> • Techniques and methods of seedbed preparation implements and tools <p>Discussion Let the participants recall what they learned and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • PowerPoint Presentation • Distribute participants' handouts • Brochures, leaflets and manual
13.7.4 Roof water Harvesting (15 minutes)	Session guide
<p>Plenary Presentation (15 minutes)</p> <ul style="list-style-type: none"> • Techniques and methods of water harvesting in Greenhouse conditions <p>Let the participants recall what they learnt and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • Flip charts • PowerPoint presentation • Distribute participants' handouts
13.7.5 Calibration of fertilizer and seed rates for planters (10 minutes)	Session guide
<p>Plenary Presentation)</p> <ul style="list-style-type: none"> • Techniques and methods of calibration of fertilizer and seed planter equipment and tools (30 minutes) <p>Let the participants recall what they learnt and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • Distribute participants' handouts • Brochures, leaflets and manual

13.7.6 Use of pest control implements and tools (20 minutes)	Session Guide
<p>Plenary Presentation (10 minutes)</p> <ul style="list-style-type: none"> • Techniques and methods of using tomato pest control equipment and tools in pest discussion (30 minutes) <p>Let the participants recall what they learnt and discuss any issue that may arise.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Brochures, leaflets and manual
13.7.7 Machine and procedure for tomato size grading (10 minutes)	Session Guide
<p>Plenary Presentation PowerPoint Presentation Highlighting on:</p> <ul style="list-style-type: none"> • Equipment for tomato size grading <p>Discussion Let the participants recall what they learned and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Brochures, leaflets and manual
13.7.8 Module review (10 minutes)	Session Guide
<p><i>The trainer leads the trainees in reviewing the module)</i> Summarize the main points of the training and together with the trainees review the main points:</p> <ul style="list-style-type: none"> • Climate smart tillage options • Seedbed preparation tools • Roof water harvesting (greenhouse) • Calibration of fertilizer and seed rates for planters • Use of pest control implements and tools • Machine and procedure for tomato grading • Machine and procedure for green-grading. <p><i>(Discuss with participants about new things learnt from this module. What are some of the problems and issues that they have become more aware of in the module?)</i></p>	<ul style="list-style-type: none"> • The last participants' handouts • Summary of the main points on from the module on a flip chart and display

13.8 Participants Handouts

KALRO tomato mechanization factsheet

MODULE 14

TOMATO BUSINESS AND MARKETING

14.1 Introduction to the Module

This module introduces service providers, lead farmers and trainers to the importance of tomato farming as a business. The module also focuses on helping farmers to acquire sustainable business skills that will assist them to build a long-term financial resilience to the negative impact of increasing drought and poverty. This will be achieved through production and development of marketable tomato products that contribute to addressing improved food and nutritional security and better income at the household level. This is consistent with Kenya Government strategy for commercializing agriculture and the current government policy whose aim is to make the agriculture sector profitable, commercially oriented, and competitive. The areas covered under this module include the concept of tomato farming as a business, opportunities of tomato products in local and international markets, risk management in tomato farming business, market analysis and importance of a strengths, weaknesses, opportunities and threats (SWOT) analysis, farm decision analysis tools (partial budget, break-even and gross-margin) and business plan and marketing of tomato farm products.

14.2 Module Learning Outcomes

By the end of this module training, the following outcomes should be achieved:

- Importance of tomato farming for subsistence and commercial appreciated
- Risks in tomato farming business and opportunities for products of this crop and requirements for participating in local and international markets identified
- The general principles for record keeping and elements and principles of preparing and implementing a profitable business plan appreciated and understood
- Types of budgets and when and how to use partial budget analysis (in farm changes and alternatives), break-even analysis and gross margin analysis discussed and appreciated
- The elements and how to conduct **SWOT** analysis matrix in marketing tomato products discussed
- The principles of 5 'Ps' in marketing tomato **production** based on **products, promotion, place** and **price** and delivery systems appreciated
- E-marketing and contract Farming appreciated.

14.3 Module Target Group

This module is intended for service providers and public extension agents in the tomato producing Counties.

14.4 Module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainers using this module should thoroughly familiarize themselves with the required participants' handouts.

14.5 Module Duration

The Module is estimated to take a minimum of 4 hours.

14.6 Module Summary

Tomato Business and Marketing			
Sessions	Training methods	Training materials	Time
14.6.1 Introduction, learning expectations and outcomes	<ul style="list-style-type: none"> ▪ Personal introductions ▪ Group discussions ▪ Plenary discussions ▪ Presentations 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations 	10 minutes
14.6.2 Subsistence and Commercial Tomato Production	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants' handouts 	30 minutes
14.6.3 Risk management in tomato farming business, opportunities and Participation requirements for Tomato products in local and international markets	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions ▪ Demonstrations 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants' handouts 	20 minutes
14.6.4 Tomato Farm Business Record Keeping and developing a Business plan	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants' handouts 	1 hour
14.6.5 Managing tomato business performance by developing Partial budget, break-even, and gross margin analysis	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical exercises ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations - Participants' handouts 	1 hour
14.6.6 Marketing of tomato products by developing SWOT matrix, use of principles of 5 'Ps', Contract Farming and E-marketing	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical exercise ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants' handouts 	40 minutes

14.6.7 Module Review	Plenary discussion	Flip charts Felt pens	20 minutes
Total			4 hours

14.7 Trainer's Guidelines

Module 14: Tomato business and marketing	
14.7.1 Introduction and Expectations (10 minutes)	Session Guide
<p><i>(The trainer welcomes trainees to the module on farming as a business and the importance of commercially oriented tomato production for enhancing employment opportunities, better incomes and livelihoods. They are then invited to introduce themselves and state their expectations).</i></p> <p>Trainees' Expectations (30 minutes) <i>(The trainer requests the trainees to form groups and list their expectations).</i></p> <p>Module Outcomes (10 minutes) (The trainer presents module learning objectives) By the end of this module training the trainee is expected to:</p> <ul style="list-style-type: none"> • Appreciate the tomato business concept. • Distinguish between subsistence and commercial farming practices. • Identify risks in tomato farming business and opportunities for its products and requirements for participating in local and international markets. • Gain knowledge on the importance of record keeping and common types of records required in a tomato farm business. • Appreciate the principles of preparing and implementing a profitable business plan. • Appreciate the concept of farm budgeting, different types of farm budgets and the components of a farm budget. • Discuss and explore the concept of marketing and approaches (SWOT, 5Ps, e-marketing and contract farming). • Evaluate different target markets and marketing channels for tomato products. 	<ul style="list-style-type: none"> • Summarize Participants' expectations and display. • PowerPoint presentation • Distribute participants' handouts on module objectives and training program
14.7.2 Subsistence and Commercial Tomato Production (30 minutes)	Session guide

<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> • Concept of a tomato business • Key principles of tomato business • Commercialization and competitiveness of tomato as a commodity crop (from subsistence to commercial farming) • Advantages of practising tomato farming as a profitable agro-enterprise. <p>Plenary Discussion (10 minutes) Concept of tomato farming as a business</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Group exercise
<p>14.7.3 Risk management in tomato farming business, Opportunities and Participation requirements for Tomato products in local and international markets (30 minutes)</p>	<p>Session Guide</p>
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> • The concept of risk • Risks associated with tomato farming business • Risk management measure at farm-level for example crop insurance • Tomato business environment both locally and internationally • Tomato production, demand and supply trends • Diversity in marketable tomato-based products • Tomato products market quality requirements and their respective prices. <p>Plenary Discussion (10 minutes)</p> <ul style="list-style-type: none"> • Let the trainees recall what they learned and discuss any issues that may arise. • Discussion on tomato products available locally and unexploited market opportunities. 	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts

14.7.4 Tomato farm business record keeping and developing a business plan for planning (1 hr)	Session Guide
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> • Why should records be kept in a tomato farm business • General principles for record keeping in tomato business • Why plan tomato business. • Elements of a successful business plan • Guidelines and steps in preparing a competitive and profitable business plan • Characteristics of a good business plan. • <p>Practical exercises (40 minutes) <i>Trainees to develop a business plan for a tomato business (1 hour).</i></p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Business training notes • Business planning basics factsheet • Practical exercises
14.7.5 Managing tomato business performance by developing Partial budget, Break-even, and Gross margin analysis (1 hour)	Session Guide
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> • What is tomato farm budgeting? • Uses of tomato farm budgets • Common types of farm budgets • Steps in preparing farm budgets: Partial budget analysis (in farm changes or alternatives), break-even analysis and gross margin analysis <p>Practical exercises (40 minutes) <i>Trainees develop a gross margin budget for a tomato business for 1 acre (1 hour)</i></p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Business training notes • Farm budgeting factsheet • Practical exercises

14.7.6 Marketing of tomato products by developing SWOT matrix, use of principles of 5 ‘Ps’, contract farming and e-marketing (40 minutes)	Session Guide
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> • Understanding the marketing concept • How to conduct market survey for tomato products • Identification of target buyers and marketing channels • What SWOT mean for a tomato business • Describe tomato farming as a business by its SWOT • Marketing options for tomato products (5Ps) – marketing mix • Contract farming in tomato business • Role of marketing institutions. <p>Practical exercises (20 minutes) Group exercise on SWOT analysis on tomato marketing <i>(The group then compares the list from the trainer and that developed during the group exercise)</i></p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants’ handouts • Business training notes • SWOT factsheet • Practical exercise
14.7.7 Module review (20 minutes)	Session guide
<p><i>(The trainer leads the trainees in reviewing the module and summarizes the main points of the training and together with the trainees).</i></p> <ul style="list-style-type: none"> • Transformation process of tomato farming from subsistence to commercial. • Options for risk management in tomato business. • Opportunities for tomato products in local and international markets. • Participation requirements in local and international markets. • Importance of record keeping and business plan. • Tools for financial management. • Marketing options for tomato products. <p><i>(Each trainees’ lists the main points learnt during the training. Discuss with trainees new things learnt from this module. What are some of the problems and issues that they have become more aware of in the module?)</i></p>	<ul style="list-style-type: none"> • Group discussions • Q&A session • Recap the main points • Test understanding • Participatory evaluation of the session

14.8 Participant’s Handout

Reference

1. KALRO (2020). Tomato Marketing Factsheet

MODULE 15

TOMATO CROSS CUTTING ISSUES

SUB-MODULE 15.1: AGRICULTURAL INNOVATION PLATFORMS

15.1.1 Introduction to the Sub-Module

This sub-module exposes the service providers, lead farmers and trainers to an innovation systems based configuration of stakeholders called the Agricultural Innovation Platform (AIP). It is an organizational model for stimulating innovation and development and brings actors together in a way that pools together skills and knowledge used to address challenges and utilize opportunities. The actors include individuals, private and public sector organizations, policy makers and other value chain stakeholders and are brought together to seek a solution to a challenge hindering agricultural productivity within a value chain such as tomato. The AIP facilitates actors to interact, innovate, learn and change with time as they seek a solution to the common challenge or compelling agenda. In an innovation platform, information exchange takes place in an environment where every actor's contribution is valued and various benefits accrue to all in a win-win situation.

15.1.2 Sub-module learning Outcomes

By the end of the module, the following outcomes the trainees' should be achieved:

1. Attributes of an innovation platform described
2. Stakeholders mobilization for initiation of an AIP demonstrated
3. The establishment, management and monitoring of AIPs demonstrated
4. Process of building innovation capacity of the actors described

15.1.3 Sub-module Target Group and Categories

The target users are public county extension officers, private agricultural service providers, and lead farmers.

15.1.4 Sub-module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainer using this module should thoroughly familiarize themselves with the participants' handouts.

15.1.5 Sub-module Duration

The module is estimated to take 5 hours

15.1.6 Sub-module Summary

Sub-module Summary			
Sessions	Training methods	Training materials	Time
15.1.6.1 Introduction, objectives and expectations	<ul style="list-style-type: none"> ▪ Personal introductions ▪ PowerPoint presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation 	10 minutes
15.1.6.2 An overview of attributes of an Agricultural Innovation Platform	<ul style="list-style-type: none"> ▪ PowerPoint presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Participants' handouts 	20 minutes
15.1.6.3 Pre-formation stages –stakeholder mobilization and sensitization.	<ul style="list-style-type: none"> ▪ PowerPoint presentations ▪ Plenary discussions ▪ Role plays 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Handouts ▪ Roles 	20 minutes
15.1.6.4 AIP Phases (Initiation, Establishment, Management and Sustenance)	<ul style="list-style-type: none"> ▪ PowerPoint presentations ▪ Plenary discussions ▪ Role plays ▪ Video clip 	<ul style="list-style-type: none"> ▪ Flip charts ▪ PowerPoint presentation ▪ Handouts ▪ Roles 	1 hour
15.1.6.5 Module review	<ul style="list-style-type: none"> ▪ Discussions 	<ul style="list-style-type: none"> ▪ Flip Charts 	10 minutes

Total			2hours
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15.1.7 Trainer’s Guidelines

Module 15.1: Agricultural Innovation Platform	
15.1.7.1. Introduction, levelling of expectations and objectives (10 minutes)	Session Guide
<p>Introduction (10 minutes)</p> <p><i>(The trainer welcomes trainees to the module on Agricultural Innovation Platforms. They are then invited to introduce themselves and state their expectations).</i></p> <p>Module Objectives (10 minutes)</p> <p><i>(The trainer presents modules objectives and levels out expectations).</i></p> <p>By the end of the module training, the trainee should be able to:</p> <ul style="list-style-type: none"> • Explain characteristics of an innovation platform. • Mobilize and sensitize stakeholders. • Describe how to initiate and establish AIP • Explain how to manage and sustain innovation capacity of actors in AIP. 	<ul style="list-style-type: none"> • Summarize trainees’ “expectations” and display. • PowerPoint presentation • Module objectives and training program
15.1.7.2. The characteristics of an innovation platform (20 minutes)	Session Guide

<p><i>(The trainer should present an overview of innovation platforms and their main characteristics).</i></p> <p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> • Past progression of research and extension models and their shortcomings • Agricultural Innovation Systems perspective and AIP model • Comparison of AIP with social and technical events working through committees with different roles but common goals • Value chain actor linkages and other benefits. <p>Discussion (10 minutes) Let the trainees recall what they learnt and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Notes handouts, • Brochures, information leaflets and manuals
<p>15.1.7.3. Preformation and formation phases of the Tomato AIP (20 minutes)</p>	<p>Session Guide</p>

<p>Plenary Presentation (20 minutes) Trainer presents on:</p> <p>Initiation or preformation phase</p> <ul style="list-style-type: none"> Engagement or mobilization of stakeholders in the tomato value chain Visioning process and rules of engagement mediated by an initiator such as an change agent. <p>Establishment</p> <ul style="list-style-type: none"> Assessment of the status of the value chain to clearly identify the compelling agenda or bottleneck - Agriculture Product Value Chain (APVC) analysis to identify weaknesses in the chains Laying out of proper plans to define roles, establish task-based committees, expected milestones and resourcing strategies. <p>Management</p> <ul style="list-style-type: none"> Keeping stakeholders focused on the vision and upholding values to ensure an inclusive and transparent process Neutral facilitation to ensure joint strategy building and action and the coordination of support activities Managing emerging experts taking up leading roles and issues as champions. <p>Sustainability</p> <ul style="list-style-type: none"> Guiding in evolving and identifying fresh issues or challenges Maintaining capacity acquired to address new issues or challenges in subsequent cycles. <p>Discussion (10 minutes) Let the trainees recall what they learnt and discuss any issues that may arise</p>	<ul style="list-style-type: none"> Powerpoint presentation Distribute participants' handouts Brochures, leaflets, manuals Short video clips
<p>15.1.7.4. Module review (10 minutes)</p>	<p>Session Guide</p>
<p><i>(The trainer leads the trainees in reviewing the module).</i></p> <p>Summarize the main points of the training and together with the trainees review the main points on:</p> <ul style="list-style-type: none"> AIP characteristics and initiation AIP establishment and management Sustenance of tomato AIPs <p><i>(Discuss with trainees new things learnt from this module. What are some of the problems and issues that they have become more aware of in the module)?</i></p>	<ul style="list-style-type: none"> The last Participants' Handouts Summarize the main points from the module on a flip chart and display

15.1.8 Participants' Handouts and References

1. KALRO (2020). Tomato Innovation Platform. Factsheet

References

1. Kamau, G.M. and Makini F.W. (2019) Agricultural Innovation Platforms for knowledge exchange and learning for technical, economic, social and institutional change
2. Felister Makini, Wellington Mulinge, Lawrence Mose, Beatrice Salasya, Geoffrey Kamau, Margaret Makelo, and On'gala, J. (2018) Impact of Agricultural Innovation Platforms on Smallholder livelihoods in Eastern and Western Kenya. FARA Research Results Vol2(6)
3. F. Makini, G. Kamau, M. Makello, A. Adekunle, G. Mburathi. (2013) Operational field guide for developing and managing local agricultural innovation platforms KARI ISSN 978-9966-30-004-1
4. **Gabriel Teno and Jean-Joseph** Cadilhon (2016) Innovation platforms as a tool for improving agricultural production: the case of Yatenga province, northern Burkina Faso (Journal of field actions, vol 9, 2016)

SUB-MODULE 15.2

TOMATO GENDER, VULNERABLE AND MARGINALIZED GROUPS (VMGs), SOCIO, ENVIRONMENTAL CONCERNS AND COHESION

15.2.1 Introduction to the Sub-module

Tomato is a major agro-enterprise and therefore all the gender categories [men, women, youth vulnerable marginalized groups (VMGs)] are involved in its value chain from production, marketing and consumption. However, women perform most of the tomato production activities such as planting, weeding and harvesting while men mostly perform the task of marketing. Despite this huge women's contribution, gender inequalities exist in all areas of the value chains. Some of these gender inequalities include: division of labour, access to and control of resources and decision making within and beyond the household. These inequalities limit women, youth and VMGs access to and benefits from the various Technologies Innovations and Management Practices (TIMPs) at different nodes of the value chain. At the macro-level, effective participation of women and youth in groups and market activities is constrained by their low decision making power, lack of voice and lack of access to financial resources. Gender analysis examines the productive and reproductive roles of men and women; access, control and ownership of resources; levels of power relations; differential needs, constraints and opportunities; and impact of these differences (positive/negative) on lives of men, women, youth and the VMGs.

Tomato value chain TIMPs interventions, when designed and implemented with gender equitable principles, can foster adoption leading to increased productivity as well as

enhanced social and environmental impacts. The overall objective of this module is to ensure that gender mainstreaming and social inclusion in tomato TIMPs is enhanced by field agricultural practitioners and extension officers as an effort geared towards achieving Climate Smart Agriculture “triple win” in target counties.

15.2.2 Sub-module learning outcomes

By the end of the sub-module training, the following outcomes should be achieved:

- Understanding of the concept of gender mainstreaming and social inclusion in tomato value chain enhanced
- Appreciation of youth empowerment in tomato value chain increased
- understanding of women empowerment in tomato value chain increased
- Inclusion of the strategies for inclusion of vulnerable and marginalized groups in tomato value chain increased
- Appreciation of socio-cultural barriers in tomato value chain increased
- Environmental and social management framework (ESMF) tool explained and understood.

15.2.3 Sub-module Target Group

This sub-module is intended for service providers and county private and public extension agents

15.2.4 Sub-module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). This module outlines the learning outcomes, the category of trainees targeted, module summary, and participants’ handouts. The trainer using this module should thoroughly familiarize themselves with the participant’s handouts.

15.2.5 Sub-module Duration

The module is estimated to take 2 hours.

15.2.6 Sub-module Summary

Gender mainstreaming and social inclusions in the tomato value chain			
Sessions	Training methods	Training materials	Duration
15.2.6.1 Introduction, expectations and objectives	<ul style="list-style-type: none"> ▪ Personal introductions ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint Presentation ▪ Laptop ▪ Participants’ handouts 	10 minutes

15.2.6.2 Gender mainstreaming in green value chain	<ul style="list-style-type: none"> ▪ PowerPoint Presentations ▪ Group discussions ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentation ▪ Participants handouts 	30 minutes
15.2.6.3 Youth empowerment in tomato value chain	<ul style="list-style-type: none"> ▪ PowerPoint Presentations ▪ Group discussions ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentation ▪ Participants' handouts 	30 minutes
15.2.6.4 Women empowerment in tomato value chain	<ul style="list-style-type: none"> ▪ PowerPoint Presentations ▪ Group discussions ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flipcharts ▪ Felt pens ▪ PowerPoint presentation ▪ Participants' handouts 	30 minutes
15.2.6.5 Strategies for inclusion of vulnerable and marginalized groups	<ul style="list-style-type: none"> ▪ PowerPoint Presentations ▪ Group discussions ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentation ▪ Participants' handouts 	30 minutes
15.2.6.6 Environmental and Social Management Framework	<ul style="list-style-type: none"> ▪ PowerPoint Presentations ▪ Group discussions ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentation ▪ Participants' handouts 	20 minutes
15.2.6.7 Socio economic and environmental impact of tomato activities	<ul style="list-style-type: none"> ▪ PowerPoint presentations ▪ Group discussions ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentation ▪ Participants' handouts 	20 minutes
15.2.6.8 Module Review	<ul style="list-style-type: none"> ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens 	

Total		3 hours
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15.2.7 Trainer’s Guidelines

Sub-module 15.2: Gender mainstreaming and social inclusion in tomato value	
15.2.7.1 Introduction, Objectives and Expectations (10)	Session Guide
<p><i>(The trainer welcomes trainees to the module on gender mainstreaming and social inclusion in tomato value chain. They are then invited to introduce themselves and state their expectations).</i></p> <p>Sub-module Objectives (10 minutes) <i>(The trainer presents modules objectives).</i></p> <p>By the end of the module training the trainee is expected to:-</p> <ul style="list-style-type: none"> • Enhance understanding of the concept of gender mainstreaming and social inclusion in tomato value chain. • Increase appreciation of youth empowerment in tomato value chain. • Increase understanding of women empowerment in tomato value chain. • Increase inclusion of the strategies for inclusion of vulnerable and marginalized groups in tomato value chain. • Increase appreciation of socio-cultural barriers in tomato value chain. • Explain environmental and social management framework (ESMF) tool. 	<ul style="list-style-type: none"> • Summarize trainees’ “expectations” and display. • Powerpoint presentation • Flipcharts • Group exercise • Objectives and training program
15.2.7.2 Gender mainstreaming and social inclusion in tomato value chain (30 minutes)	Session Guide

<p><i>(The trainer should present and explain what is gender mainstreaming, who does what activity, who has access to what resources etc. and why gender mainstreaming is important in tomato value chain).</i></p> <p>Plenary Presentation (20 minutes)</p> <p>PowerPoint presentation on the following:</p> <ul style="list-style-type: none"> • Definition of gender. • What is gender mainstreaming and why it is important. • Who does what? (gender division of roles in tomato value chain). • Who owns what? (access and control of resources & benefits). • Who makes which decisions? • Socio-cultural limitations related to the tomato value chain. • Existing policies in support of gender mainstreaming. <p>General discussion (10 minutes)</p> <p>Let the trainees recall what they learned and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • Powerpoint presentation, group exercise • Plenary discussions • Distribute participants handouts • Group exercise • Plenary discussions
<p>15.2.7.3 Youth empowerment in tomato value chain (30 minutes)</p>	<p>Session Guide</p>
<p>Plenary Presentation (10 minutes)</p> <p>PowerPoint presentation highlighting:</p> <ul style="list-style-type: none"> • Why agriculture is not attractive to youth. • Youth's role in the value chain. • Strategies to empower youth in the tomato value chain. <p>Group work 10 minutes)</p> <p>Group discussion (10 minutes)</p> <p>Let the trainees recall what they learned and discuss any issues that may arise.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Group exercise • Plenary discussion
<p>15.2.7.4 Women empowerment in tomato value chain (30 minutes)</p>	<p>Session Guide</p>

<p>Plenary Presentation (10 minutes) PowerPoint presentation highlighting:</p> <ul style="list-style-type: none"> • Women’s role in the value chain. • Challenges facing women in the value chain. • Strategies for empowering women in the value chain. <p>Group exercise (10 minutes)</p> <p>Plenary discussion (10 minutes)</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants’ handouts • Group exercise • Plenary discussion
<p>15.2.7.5. Strategies for inclusion of vulnerable and marginalized groups in tomato value chain (20 minutes)</p>	<p>Session Guide</p>
<p>Plenary Presentation (10 minutes)</p> <ul style="list-style-type: none"> • Who are vulnerable and marginalized groups (VMGs). • Why gender inequalities exist. • Social inclusion and why. • Strategies of inclusion of VMGs. <p>Group exercise (5 minutes)</p> <p>Plenary discussions (5 minutes)</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Group exercise • Plenary discussion
<p>15.2.7.6. Environmental and social management framework (ESMF) (20 minutes)</p>	<p>Session Guide</p>
<p>Plenary Presentation (10 minutes)</p> <ul style="list-style-type: none"> • Objective of ESMF in tomato value chain • Environmental, social risks • Environmental and social safeguards • Environmental and socioeconomic impacts of tomato value chain activities <p>Group exercise (5 minutes)</p> <p>Plenary discussion (5 minutes)</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Group exercise • Plenary discussion
<p>15.2.7.7 Module review (10)</p>	<p>Session Guide</p>

(The trainer leads the trainee in reviewing the module).

Summarize the main points of the training and together with the participants review the main points:

- What is gender mainstreaming and why it is important?
- Youth empowerment in tomato value chain
- Women empowerment in tomato value chain
- Strategies for inclusion of vulnerable and marginalized groups in tomato value chain
- Socio-cultural barriers in the value chain
- Environmental and socioeconomic impacts of tomato activities

Let the participants recall what they learnt and discuss any issues that may arise.

- Summary of the main points on from the module on a flip chart and display

15.2.8 Participant's Handouts

KALRO factsheet on Gender in tomato production

SUB-MODULE 15.3

CLIMATE-SMART AGRICULTURAL POLICY OPTIONS

15.3.1 Introduction to the Sub-module

Kenya adopted Vision 2030 in 2007 as a blue print and roadmap for political, social and economic development of the country in the next two decades. The Vision identifies Agriculture as the engine of growth through transformation of smallholder and subsistence agriculture to innovatively and commercially oriented agriculture. Kenya promulgated the new constitution in 2010 which proposes two levels of governments (national & county) with defined functions. Agriculture is one of the devolved governance functions. However, agriculture in Kenya is facing many challenges and threats such as climate change, declining agricultural performance, limited high potential agricultural land and over-reliance on rain fed agriculture, limited diversification of agricultural production, poor and inadequate rural infrastructure, inadequate and declining research in agriculture, reduced agricultural sector financing and related activities and low technical capacity among the actors. Therefore, agricultural policy in Kenya revolves around the main goals of increasing productivity and income growth, especially for smallholders; enhanced food security and equity, emphasis on irrigation to introduce stability in agricultural output, commercialization and intensification of production especially among small scale farmers; appropriate and participatory policy formulation and environmental sustainability. This module introduces the national and county governments, service providers, lead farmers, trainers and relevant stakeholders in the design and implementation of effective climate-smart-sensitive agricultural policy options to promote the transition to climate-smart agriculture at the smallholder level. The policy context of this module is structured around six topics.

15.3.2 Sub-module Learning Outcomes

By the end of this Sub-module training, the following outcomes should be achieved:

- The role of agricultural policy frameworks in Kenya appreciated
- Climate-smart agriculture practices, policy options and approaches explored and explained
- Climate-smart-sensitive policy cycle explained
- Implementation of the climate-smart-sensitive policy at the county level explained and understood
- Financing and investments for climate-smart agriculture explained
- The need for a Technology Policy advocated for.

15.3.3 Sub-module Target Group

This sub-module is intended for service providers, policy makers, public extension agents and relevant stakeholders in the design and implementation of effective, climate-smart-

sensitive agricultural policies.

15.3.4 Sub-module Users

This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The trainers using this module should thoroughly familiarize themselves with the required participant's handouts.

15.3.5 Sub-module Duration

The Module is estimated to take a minimum of 2 hours

15.3.6 Sub-module Summary

Sub-module 13: Climate-Smart Agricultural Policy Options			
Sessions	Training methods	Training materials	Time
15.3.6.1 Introduction, learning expectations and outcomes	<ul style="list-style-type: none"> ▪ Personal introductions ▪ Group discussions ▪ Plenary discussions ▪ Presentations 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations 	10 minutes
15.3.6.2 Agricultural Policy Frameworks in Kenya	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical exercises ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations 	30 minutes
15.3.6.3 Climate-smart agriculture practices, policy options and approaches	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical exercises ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants' handouts 	40 minutes
15.3.6.4 Climate-smart-sensitive policy cycle	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations - Participants handouts 	20 minutes

15.3.6.5 Implementation of the climate-smart-sensitive policy at the county level	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical exercise ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants' handouts 	20 minutes
15.3.6.6 Financing and Investments for Climate-smart Agriculture	<ul style="list-style-type: none"> ▪ Presentations ▪ Practical exercise ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants handouts 	20 minutes
15.3.6.7 Technology Policy	<ul style="list-style-type: none"> ▪ Presentations ▪ Plenary discussions 	<ul style="list-style-type: none"> ▪ Flip charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants' handouts 	20 minutes
15.3.6.8 Module Review	Plenary discussion	Flip charts Felt pens	10 minutes
Total			2 hours

15.3.7 Trainer's Guidelines

Sub-module 15.3: Climate-Smart Agricultural Policy Options	
15.3.7.1 Introduction, expectations and outcomes (10 minutes)	Session Guide
<p><i>(The trainer welcomes trainees to the module on Climate-Smart Agricultural Policy Options and the importance in Agriculture to undergo a significant transformation in order to meet the related challenges of food security and climate change for enhancing employment opportunities, better incomes and livelihoods. They are then invited to introduce themselves and state their expectations).</i></p> <p>Sub-module Outcomes (10 minutes) <i>(The trainer presents module learning objectives).</i> By the end of this module training, the trainee is expected to:</p> <ul style="list-style-type: none"> • Appreciate the role of agricultural policy frameworks in Kenya. • Understand climate-smart agriculture practices, options and approaches. • Understand the stages in climate-smart-sensitive policy cycle. • Understand the phases in the implementation of the climate-smart-sensitive policy at the county level. • Be able to evaluate and select financing and investments options for climate-smart agriculture. • Be able to understand the need of a technology policy. 	<ul style="list-style-type: none"> • Summarize trainees' "expectations" and display. • Powerpoint presentation • Distribute participants' handouts on module objectives and training program

15.3.7.2 Agricultural Policy Frameworks in Kenya (30 minutes)	
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> The role of agricultural policy frameworks in Kenya <p>Practical Exercise and Plenary Discussions (10 minutes) <i>(The trainer requests the trainees to form groups and identify the gaps between agricultural policy frameworks and the existing agricultural policies).</i></p>	<ul style="list-style-type: none"> PowerPoint presentation Distribute participants' handouts Group exercise
15.3.7.3 Climate-smart agriculture practices, policy options and approaches (40 minutes)	Session guide
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> Considerations for climate-smart production systems. Existing systems, practices and methods suitable for climate-smart agriculture. Institutional and policy options. Ensuring farmer organizations for market access. Gendered approach. <p>Practical Exercise (10 minutes) <i>(The trainer requests the trainees to form groups and identify the existing climate-smart agriculture practices and the relevant policy options for implementation).</i></p> <p>Plenary Discussions (10 minutes)</p>	<ul style="list-style-type: none"> PowerPoint presentation Distribute participants' handouts Group exercise
15.3.7.4 Climate-smart-sensitive policy cycle (20 minutes)	Session Guide
<p>Plenary Presentation (10 minutes)</p> <ul style="list-style-type: none"> Stages in the climate-smart-sensitive policy cycle. <p>Plenary Discussions (10 minutes)</p>	<ul style="list-style-type: none"> PowerPoint presentation Distribute participants' handouts
15.3.7.5 Implementation of the climate-smart-sensitive policy at the county level (20 minutes)	Session Guide
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> Phases in the implementation of the climate-smart-sensitive policy at the county level. <p>Practical exercise (10 minutes) <i>(The trainer requests the trainees to form groups and develop a program showing steps, activities and stakeholders for the implementation of climate-smart policies).</i></p>	<ul style="list-style-type: none"> PowerPoint presentation Distribute participants' handouts Practical exercise

15.3.7.6 Policy financing and investments for Climate-smart Agriculture (20 minutes)	Session Guide
<p>Plenary Presentation (20 minutes)</p> <ul style="list-style-type: none"> • Why financing is needed • Financing gaps • Sources of financing • Financing mechanisms • Connecting action to financing • Types of subsidies to farmers <p>Practical exercises (10 minutes) <i>(The trainer requests the trainees to form groups and identify potential sources of financing, financing mechanisms and connecting action to financing).</i></p> <p>Plenary Discussions (10 minutes)</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts • Practical exercise
15.3.7.7 Need of Technology Policy (20 minutes)	Session guide
<p>Plenary Presentation (10 minutes)</p> <ul style="list-style-type: none"> • What is a technology policy? • Why do we need technology policy? • Is technology policy inconsistent with a market oriented economy? • Technology policy in Kenya <p>Plenary Discussions (10 minutes)</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Distribute participants' handouts
15.3.7.8 Sub-module review (10 minutes)	Session guide
<p><i>(The trainer leads the participants in reviewing the module).</i> Summarize the main points of the training and together with the trainees review the main points: (Each trainee lists the main points learnt during the training. Discuss with participants new things learnt from this Module. What are some of the problems and issues that they have become more aware of in the module?)</p>	<ul style="list-style-type: none"> • Q&A session • Recap the main points • Test understanding • Participatory evaluation of the session

15.3.8 Participants' Handouts and references

1. Alila, P.O. & Atieno, R. (2006). A paper for the Future Agricultures Consortium workshop, Institute of Development Studies, 20-22 March 2006. Future Agricultures.
2. Chronic Poverty Advisory Network (2012). Agriculture Policy Guide 2. Meeting the challenge of a new Pro-poor agricultural paradigm: The role of agricultural policies and programs. www.chronicpovertynetwork.org
3. Chirwa, E.; Dorward, A.; Kathule, R.; Kumwenda, I.; Kydd, J., Poole, N.; Poulton, C. & Stockbridge, M. (undated). Farmer Organization for market access:

Principles for policy and practice. Imperial College London. University of Malawi. Agricultural Policy Research Unit. <http://www.imperial.ac.uk/agriculturalsciences/research/sections/aebm/projects/farmerorg.htm>

4. Food and Agriculture Organization of the United Nations (2016). The Gender in Agricultural Policies Analysis Tool (GAPo). FAO 2016.16274EN/2/01.18
5. Food and Agriculture Organization of the United Nations (FAO) (2010). “Climate-Smart” Agriculture. Policies, Practices and Financing for Food Security, Adaptation and Mitigation.
6. Ha-Joon Chang (2002). African Technology Policy Studies Network (ATPS). Who needs Technology Policy? Published by The African Technology Policy Studies Network, Nairobi, Kenya. ISBN: 9966-916-18-0
7. RoK (2007). Kenya adopted Vision 2030.
8. RoK (2010). Kenya Constitution

Annex 1: Training Program

Time	Day 0 (Sunday) 19 th April	Duration	Remarks / Trainer
Late Evening	<ul style="list-style-type: none"> · Arrival of participants and registration – Host · Setting up and prepare training venue and materials – CTT	2hours	The training venue and materials are ready for use
<i>Close of Day 0</i>			
Time	Day 1 (Monday) 20 th April	Duration	Remarks / Trainer
8.30am–10.30am	Climate Setting <ul style="list-style-type: none"> · Welcome by host and Prayers · Self-introductions –(CTT) · Introduction to KCSAP project · Official opening Ceremony (CDA) · Introduction to the training program (CTT) · Formation of groups and setting norms (CTT) 	5 minutes 15 minutes 10 minutes 10 minutes 15 minutes 15minutes	The trainees relax and climate set for the ten-day training
10.30am–10.45am	Tea Break (Group Photo)	15 minutes	Health Break
11.45am-1.45pm	Module 1: Climate Smart Agriculture Practices <ul style="list-style-type: none"> • Introduction, objectives and expectations • Understanding climate change • Climate change impacts on agriculture and food security • Climate smart agriculture and context specific practices • Model review 	15minutes 30 minutes 30 minutes 30 minutes 15 minutes	1st module training

1.45pm- 2.30pm	Lunch break	45 minutes	
2.30pm-6.0pm	<p>Module 2: Farmer Field Business School (FFBS) Approach</p> <p>Introduction and levelling of expectations</p> <p>Introduction to FFBS</p> <p>Designing an FFBS program</p> <p>Key activities in FFBS</p> <p>Introduction to communication and facilitation skills</p> <p>Organization, management and leadership in FFBS</p> <p>Module review</p>	<p>4rhrs</p> <p>10 minutes</p> <p>40 minutes</p> <p>1 hour</p> <p>1 hour</p> <p>30 minutes</p> <p>30 minutes</p> <p>10 minutes</p>	
Time	Day 2 (Tuesday) 21 st April	Duration	Remarks / Trainer
8.00am-10.00am	<p>Module 3: Tomato niches and suitable varieties</p> <ul style="list-style-type: none"> • Introduction and levelling of expectations • Introduction to tomato variety categories/types • Varieties for open field cultivation, • Varieties for Greenhouse cultivation • Sources of seed • Tomato field visit • - Visit to field with tomato in open field and in greenhouse • Module Review 	<p>10 minutes</p> <p>10 minutes</p> <p>20 minutes</p> <p>20 minutes</p> <p>20 minutes</p> <p>30 minutes</p> <p>10 minutes</p>	
10.00am-10.15am	Health Break	15 minutes	

10.15am- 2.15pm	<p>Module 4 Tomato seed/seedlings production</p> <ul style="list-style-type: none"> · Introduction to tomato nursery · Introduction to tomato propagation and nursery management · Nursery site selection establishment and management in open field · Seeding · Greenhouse nursery set up and management · Selection and preparation of seedlings for transplanting · Tomato grafting · Module review 	<p>10 minutes 30 minutes 1 hr 1 hour 30 minutes 1 hour 20 minutes</p>
2.15pm-3.00pm	Lunch break	45 minutes
3.00pm - 6.00pm	<p>Module 5 Agronomic practices for open field tomato cultivation</p> <ul style="list-style-type: none"> · Introduction and levelling of expectations · Introduction to agronomic practices · Site selection, land preparation and crop rotation · Transplanting, spacing and fertilizer application · Weeding, mulching and irrigation · Staking, pruning, de-flowering and defoliation · Module review 	<p>20 minutes 30 minutes 30 minutes 30 minutes 40 minutes 40 minutes 10 minutes</p>
<i>Close of Day 2</i>		

Time	Day 3 (Wednesday) 22 nd April	Duration	Remarks / Trainer
8.30am-10.30am	<p>Module 6 Greenhouse Tomato Cultivation</p> <p>Introduction, objectives and expectations</p> <ul style="list-style-type: none"> · Introduction to greenhouse tomato production · Appropriate greenhouses for production of high quality tomato media for greenhouse tomato production · Planting systems for greenhouse tomato production · Nutrition management · Training and pruning · Irrigation using drip and capillary wick methods · Bio-degradable mulching materials for weed management and moisture retention · Model review 	<p>10 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>10 minutes</p>	
10.30am-10.45am	Tea Break	15 minutes	Health Break
10.45am-12.45pm	<p>Module 7: Integrated soil and water management practices for tomato production</p> <p>Introduction, objectives and expectations</p> <p>Soil composition, properties and health and conduct Soil sampling and analysis practical's</p> <p>Soil fertility and plant nutrition</p> <p>Soil health and ISFM for climate resilient cropping systems</p> <p>Soil degradation and reclamation</p>	<p>10 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>30 minutes</p>	
12.45pm-2.30pm	Lunch Break	45minutes	

2.30pm-4.30pm	<p>Module 7: Integrated soil and water management practices for tomato production</p> <ul style="list-style-type: none"> • Problematic soils and their management • Drip irrigation technology • Module review and discussions 	<p>30 minutes</p> <p>30 minutes</p> <p>10 minutes</p>	
4.30pm-4.15pm	Coffee Break	1 hour	
4.15pm-7.15pm	<p>Module 8: Pest management in tomato</p> <p>Introduction and climate setting, objectives and expectations</p> <p>Terminologies used in pest management and their economic importance</p> <p>Scouting and how to undertake scouting in a tomato field.</p> <p>Identification of the different tomato pests and their mode of destruction</p> <p>Management options for the different tomato pests</p> <p>Module review</p>	<p>10 minutes</p> <p>20 minutes</p> <p>30 minutes</p> <p>1hour</p> <p>40 minutes</p> <p>10 minutes</p>	
<i>Close of Day 3</i>			
Time	Day 4 (Thursday) 23rd April	Duration	Remarks / Trainer

8.30am-11.30am	<p>Module 9 Tomato Diseases and their Management</p> <ul style="list-style-type: none"> · Introduction, objectives and expectations · The impact of diseases on tomato production (yield losses, quality issues, costs, etc.) · Fungal, bacterial and viral diseases, nematodes and physiological disorders of economic importance in tomato · Analyses of the critical factors in disease occurrence and management · Management of tomato diseases · Pesticides application and safe use · Module Review 	<p>10 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>30 minutes</p> <p>10 minutes</p>	
11.30am-11.45am	Tea Break	15 minutes	Health Break

11.45am-2.45pm	<p>Module 10: Weed management in tomato</p> <ul style="list-style-type: none"> • Introduction and climate setting, objectives and expectations • Analyses of critical factors in weed occurrence and their management and their impact on tomato production • Identification of the different weeds of economic importance in tomato, broad leaf, grasses, sedges and parasitic weeds, and their mode of destruction • Management options for the different weeds that occur in tomato fields • Module review 	<p>15 minutes 30 minutes 1 hour 1 hour 15 minutes</p>	
2.45pm-3.30pm	Lunch Break	1 hour	
3.30pm-5.30pm	<p>Module 11 Tomato harvesting and postharvest management</p> <p>Introductions and levelling of expectations</p> <p>Introduction to tomato postharvest handling</p> <p>Maturity indices and harvesting</p> <p>Tomato postharvest handling practices</p> <p>Module review</p>	<p>10 40 30 30 10</p>	
Day 5 (Friday) 24 th April			

8.00am - 10.00am	<p>Module 12 Tomato processing</p> <ul style="list-style-type: none"> · Introductions and levelling of expectations · Introduction to tomato processing · Prioritizing opportunities in tomato processing · Processing of tomato into pulp · Use of solar dryer to dehydrate tomato · Module review 	<p>10 minutes 20 minutes 20 minutes 30 minutes 30 minutes 10 minutes</p>	
10.00-10.15am	<p>Health break</p>	15 minutes	
10.15am-12.15pm	<p>Module 13: Mechanization of Tomato Production Activities</p> <ul style="list-style-type: none"> Introduction, objectives and expectations Climate smart tillage options Seedbed preparation tools Roof water harvesting (greenhouse) Calibration of fertilizer and seed rates for planters Use of pest control implements and tools Machine and procedure for tomato grading Module review 	<p>10 minutes 15 minutes 20 minutes 15 minutes 20 minutes 20 minutes 10 minutes 10 minutes</p>	

12.15am-2.15pm	<p>Module 14: Tomato Business and Marketing</p> <p>Introduction, learning expectations and outcomes</p> <p>Subsistence and commercial tomato production</p> <p>Risk management in tomato farming business, opportunities and participation requirements for tomato products in local and international markets</p> <p>Tomato farm business record keeping and developing a business plan for planning</p> <p>Managing tomato business performance by developing partial budget, break-even, and gross margin analysis</p> <p>Marketing of tomato products by developing Strengths, Weaknesses, Opportunities and Threats (SWOT) matrix, use of principles of 5 'ps', contract farming and e-marketing</p> <p>Module review</p>	<p>10 minutes</p> <p>30 minutes</p> <p>20 minutes</p> <p>1 hour</p> <p>1 hour</p> <p>40 minutes</p> <p>20 minutes</p>	
2.15-3.00pm	Lunch break	45 minutes	
3.00pm-5.00pm	<p>Module 15.1: Agricultural Innovation Platform</p> <p>Introduction, objectives and expectations</p> <p>An overview of attributes of an Agricultural Innovation Platform</p> <p>Pre-formation stages –stakeholder mobilization and sensitization.</p> <p>AIP Phases (Initiation, Establishment, Management and Sustenance)</p> <p>Module review</p>	<p>10 minutes</p> <p>20 minutes</p> <p>20 minutes</p> <p>1 hour</p> <p>10 minutes</p>	

	Day 6 (Saturday) 25 th April		
8.00-10.00am	<p>Module 15.2: Gender mainstreaming and social inclusions in the tomato value chain</p> <ul style="list-style-type: none"> - Introduction, expectations and objectives - Gender mainstreaming in green value chain - Youth empowerment in tomato value chain - Women empowerment in tomato value chain Strategies for inclusion of vulnerable and marginalized groups - Environmental and Social Management Framework - Socio economic and environmental impact of tomato activities - Module Review 	<p>10 minutes 30 minutes 30minutes 30 minutes 30 minutes 30 minutes 20 minutes 10 minutes</p>	
10.00-10.15am	Health break		
10.15am-12.15pm	<p>Module 15.3 Climate-Smart Agricultural Policy Options</p> <ul style="list-style-type: none"> - Introduction, learning expectations and outcomes - Agricultural policy frameworks in Kenya - Climate-smart agriculture practices, policy options and approaches - Climate-smart-sensitive policy cycle - Implementation of the climate-smart-sensitive policy at the county level - Financing and Investments for climate-smart agriculture -Technology policy -Module review 	<p>10 minutes 30 minutes 40 minutes 20 minutes 20 minutes 20 minutes 20 minutes 10 minutes</p>	
2.15pm-3.45pm	Lunch Break	45 minutes	

3.45pm-5.45pm	<p>Winding up training</p> <ul style="list-style-type: none"> · Modules and handouts materials received · Planning for farmer trainings <p>Review of the training course</p> <ul style="list-style-type: none"> · Way forward · Course evaluation (individual and group evaluation) <p>Official Closing</p> <ul style="list-style-type: none"> · Organizers concluding remarks · Participants' Remarks · Official closing remarks 	<p>20 minutes 45 minutes 20 minutes 20 minutes 20 minutes</p>	CDA / KCSAP	
Time	<i>Close of Day 6</i>		Duration	Remarks / Trainer

Annex 2. General Reference Materials

Category / Modules	Publication title	Reference types	No Pages	Farmer Category A= New entrant/ Elite Tomato farmer B= Elite Tomato Farmer
Tomato niches and suitable varieties	Tomato varieties for open field cultivation: Rio-Grande; Onyx, Cal J VF; Roma, Kilele F1	Factsheets	1-2	A/B
	Tomato varieties for Greenhouse cultivation: Anna F1, Tyka F1, Rambo F1, Bravo F1, Mavuno F1	Factsheets	1-2	A/B
Tomato seeds/ seedling production	Vegetable Nursery Practices	Brochure	2	A/B
	Tomato Nursery establishment and management	Factsheet	2	A/B
Agronomic Practices for Open Field Tomato Cultivation	Tomato Cultivation in Open field	Manual	30	A/B
	Tomato Cultivation in open field	Factsheet and brochure	2	A
Greenhouse	Greenhouse Tomato Cultivation	Manual	240	B
Soil and water Management in Tomato Cultivation	Soil Nutrition management in tomato production	Factsheet	4	A/B
	Soil and water management in tomato cultivation	Factsheet	4	A/B

Tomato crop Health	Tomato pests and Management	Factsheets (8)	2	A/B
	Tomato Diseases and Management	Factsheets (8)	2	A/B
	Weeds in tomato and Management	Factsheets (8)	2	A/B
	Scouting protocol	Factsheet	2	A/B
Tomato postharvest	Maturity indices in Tomato	Factsheet	1	A/B
	Tomato harvesting and handling. Factsheet	Factsheet	1	A/B
	Zero energy Cooler	Factsheet	1	A/B
Tomato value addition	Tomato Processing	Factsheet	2	A/B
	Tomato value added products	Manual Chapter	5	
Mechanization	Mechanization in Tomato Cultivation	Factsheets	2	A/B
Gender Mainstreaming	Gender Mainstreaming in Agriculture and Rural Development: A Reference Manual for Governments and Other Stakeholders	Manual	100	B





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Agriculture Project

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