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

TRAINING OF TRAINERS’ MANUAL


MARCH 2021
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FOREWORD

Kenya Climate-Smart Agriculture Project (KCSAP) tasked the Kenya Agricultural and Livestock Research Organization (KALRO) with the implementation of the project’s Component 2 on ‘Strengthening Climate-Smart Agricultural Research and Seed Systems’. The component activities are geared towards the development, validation, adoption and delivery of context specific climate smart agriculture (CSA) technologies, innovation and management practices (TIMPS). The other responsibility is development of sustainable seed production and distribution systems for priority value chains to enhance availability and access to improved seeds, animal breeds and fingerlings by target beneficiaries. This will be supported under Component 1 namely ‘Up scaling 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 contents are arranged in progressive modules supported by extensive information from research and background data drawn from the TIMPS. Their relevance is 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 enable achievement of the envisaged ‘Triple Wins’ of increased productivity, enhanced resilience and reduction of greenhouse gases emissions.

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
A flowering potato (Shangi variety)
PREFACE

The Kenya Climate-Smart Agriculture Project (KCSAP) is a Government of Kenya project with support from both the World Bank and the government. The project is for a five years and implemented in 24 counties, mainly in the arid and semi-arid lands (ASALs), at a approximate cost of KES 25 billion. The project development objective (PDO) is “to increase agricultural productivity and build resilience to climate change risks in the targeted smallholder farming and pastoral communities, and in the event of an Eligible Crisis or Emergency, to provide immediate and effective response.” This objective is to be achieved through the implementation of five key components, which are 1) 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 tasked with the responsibility of providing the TIMPs. Therefore, it supports the development, validation, and adoption of context specific CSA TIMPS to target beneficiaries under Components 1 and 3 as well as 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 the prioritized value chains. The crop-based value chains are 19 and include roots and tubers (cassava, potato), pulses (dry bean, green gram, pigeon peas, garden peas), vegetables (tomato, onion, indigenous vegetables, kale), cereals (sorghum, millet, teff, maize) nuts (cashew nut), fruits (banana, mango, watermelon) and fibre (cotton). Those that are animal production based are five (5) and include apiculture, indigenous chicken (meat and eggs), dairy (cattle and camel), red meat (cattle, sheep and goats) and aquaculture. Also, there are three (3) cross cutting themes on pastures and fodder, natural resource management, and animal health. The TIMPs were categorized into those ready for upscaling and those requiring validation. Furthermore, gaps that required further research and development of TIMPS were identified. Training of Trainers’ (ToT) manuals focusing on TIMPs that are ready for upscaling for each of the value chains were subsequently developed to form the basis of training county extension staff, service providers and lead farmers. Those trained are in turn expected to cascade the training to beneficiaries in the targeted smallholder farming, agro-pastoral and pastoral communities in the 24 project counties of Marsabit, Isiolo, Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.

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

The National Project Coordination Unit is grateful to all who participated in the development and production of this *Training of Trainers Manual* for Potato 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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<th>Abbreviation</th>
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</tr>
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<tr>
<td>AESA</td>
<td>Agroecosystem Analysis</td>
</tr>
<tr>
<td>AEZ</td>
<td>Agroecological zone</td>
</tr>
<tr>
<td>AIP</td>
<td>Agricultural Innovation Platform</td>
</tr>
<tr>
<td>AIV</td>
<td>African Indigenous Vegetables Technologies</td>
</tr>
<tr>
<td>BW</td>
<td>Bacterial Wilt</td>
</tr>
<tr>
<td>CA</td>
<td>Conservation agriculture</td>
</tr>
<tr>
<td>CCP</td>
<td>Critical control Point</td>
</tr>
<tr>
<td>CCT</td>
<td>County coordinating teams</td>
</tr>
<tr>
<td>CL</td>
<td>Control Limit</td>
</tr>
<tr>
<td>CSA</td>
<td>Climate smart agriculture</td>
</tr>
<tr>
<td>CTT</td>
<td>Core Team of Trainers</td>
</tr>
<tr>
<td>FFBS</td>
<td>Farmer-based business school</td>
</tr>
<tr>
<td>FSMS</td>
<td>Food safety management system</td>
</tr>
<tr>
<td>GAP</td>
<td>Good agronomic practices</td>
</tr>
<tr>
<td>GAP</td>
<td>Good agricultural practices</td>
</tr>
<tr>
<td>HACCP</td>
<td>Hazard analysis critical control points</td>
</tr>
<tr>
<td>ICM</td>
<td>Integrated crop management</td>
</tr>
<tr>
<td>IDM</td>
<td>Integrated disease management</td>
</tr>
<tr>
<td>INRM</td>
<td>Integrated natural resource management</td>
</tr>
<tr>
<td>IPDM</td>
<td>Integrated pests and diseases management</td>
</tr>
<tr>
<td>IPM</td>
<td>Integrated Pest Management</td>
</tr>
<tr>
<td>IPPM</td>
<td>Integrated production and pest Management</td>
</tr>
<tr>
<td>ISFM</td>
<td>Integrated soil fertility management</td>
</tr>
<tr>
<td>KALRO</td>
<td>Kenya Agricultural and Livestock Research Organization</td>
</tr>
<tr>
<td>KAOP</td>
<td>Kenya agriculture Observatory platform</td>
</tr>
<tr>
<td>KCSAP</td>
<td>Kenya Climate Smart Agriculture Project</td>
</tr>
<tr>
<td>PCN</td>
<td>Potato cyst Nematode</td>
</tr>
<tr>
<td>PTD</td>
<td>Participatory technology development</td>
</tr>
<tr>
<td>TIMPs</td>
<td>Technology innovations and management practices</td>
</tr>
<tr>
<td>ToTs</td>
<td>Training of Trainers</td>
</tr>
<tr>
<td>VMG</td>
<td>Vulnerable and marginalized group</td>
</tr>
</tbody>
</table>
Well sprouted seed potato tubers, (Asante variety)
INTRODUCTION

About this Manual
This training of Trainers’ Manual consists of two parts; Part I and Part II. Part I comprises notes for the facilitators while Part II is made up of the training modules in the value chain.

PART I
This part consists of four sections which include the background of the potato value chain, content of the training, training design and facilitators guidelines.
SECTION 1: BACKGROUND

1.1 The Role of Potato Value chain in Kenyan Economy
Potato (Solanum tuberosum) is the second most important food crop after maize and is grown by about 800,000 small holder farmers. It is a dynamic crop, classified as both horticultural crop for its high value and as a food security crop for its high calorie production within a short-growing season. Potato has high energy production per unit area compared to other crops and high water use efficiency per unit area. The crop plays a crucial role in food security, poverty eradication, and economic development in the country. The sub sector employs about 2.7 million actors and contributes over 50 billion shillings to the Kenyan economy. Potato value chain employs indirectly over 3.3 million people as market agents, exporters, processors, transporters, distributors and vendors. Formidable challenges and risks confront the agricultural sector in Kenya. Among the challenges is erratic performance of rain-fed agriculture flagging productivity of staple cereal crops hence the need for diversification. The rising pressure on land and other natural resources as a result of population growth has caused climate change leading to continued concerns over food insecurity which has posed major challenge to agricultural sector growth. Potato therefore holds potential as an alternative staple crop to enable the country meet its food security and nutrition obligations as well as boost economic growth.

In recent years, the Kenya Agricultural Research Institute (KARI), and now Kenya Agricultural and Livestock Research Organization (KALRO), and other collaborating institutions have developed climate smart varieties together with adaptable agronomic Technologies, Innovations and Management Practices (TIMPs) which would increase crop production for food-nutritional security and higher earnings.

1.2 The Role of Potato in Food and Nutrition Security
Potato is consumed both by the rural and urban population. In addition, potato is very versatile and can be processed into various products ranging from fresh and frozen chips, fresh crisps, industrial starch and potato flour/powder. In home consumption, potato can be baked, roasted, stewed or boiled. Potato flour can be pre-prepared as soups and baby foods. Potato may be dehydrated to lengthen shelf life and reduce postharvest losses and lengthen shelf life. Dehydrated products can be re-hydrated and cooked normally. With right market sourcing, farmers’ income could be increased three-fold through diversified potato processed products. As part of Kenya government’s “Big 4” Agenda, value added products initiative aims to contribute towards food security, improve nutrition and increase employment opportunities through flour blending based on under-utilized high value foods by 2030. Consumption of potato products will increase locally with the possibility of getting to export status in the coming years.

1.3 Potato crop as a Climate Smart Innovation
Potato has a short cropping cycle of 3-4 months, high production per unit area, highly adaptable in diverse growing environments, high water use efficiency yielding more food per unit of water than any other major crop. Production of potato can be enhanced by marching drought tolerant varieties to specific climate smart TIMPs adaptable in specific regions.
1.4 Objectives of the Training

The purpose of training is to enhance the capacity of farmer trainers, to provide and promote knowledge and skills to farmers for increased productivity of potato, through adoption of appropriate and climate smart agricultural practices. Specifically, the objectives of this training are:

a) Provision of new and relevant knowledge, technologies and skills for potato production.

b) Refreshing knowledge and skills of good agricultural practices (GAPs) for potato production including climate adaptations, variety selection, soil nutrient management, soil water conservation techniques, control of diseases and pests, post-harvest handling, value addition, mechanization, marketing and gender mainstreaming.

c) Imparting knowledge and skills in participatory techniques for effective facilitation of adult learning processes and developing inclusive stakeholder partnership for sustainable up scaling of potato technologies.

After the training, the Trainer of Trainers’ (TOTs) as facilitators will train lead farmers (LF) in various aspects of potato value chain. The training will involve providing the LF with techniques in participatory preparation, mobilization, planning, implementation, monitoring and evaluation of training sessions. The lead farmers and county extension personnel will thereafter up-scale the adoption of GAPs through farmer groups in their villages and those in the neighborhood.
SECTION 2: TRAINING CONTENT

2.1 Orientation of the Modules
The training content is organized in 14 modules that are targeted and orientated to ensure the technology and innovation management practices (TIMPs) are adopted to improve productivity through improved potato value chain competitiveness in a market driven production. The purpose of these modules is to enhance the knowledge and capacities of trainers in understanding and disseminating the climate-smart potato practices to the intended beneficiaries, who are primarily farmers.

2.2 Module Outline
Each of the 14 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** – facilitators, master trainers
- **Module duration** – minimum number of hours of exposure to materials
- **Module summary** – sequence of sessions, training methods, materials and duration
- **Facilitator’s guideline** – detailed sessions, training methods, materials and session guides
- **Participant’s handouts** – detailed notes and reference materials for trainees.

The outline of the 14 potato modules is presented in Table 1 below.
Table 1: Outline of potato value chain modules

<table>
<thead>
<tr>
<th>No</th>
<th>Module Name</th>
<th>Need Addressed</th>
<th>Expected Training Outcomes</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Climate change and climate smart agriculture</td>
<td>The impact of climate crisis to potato production</td>
<td>Master trainers made aware of the potential impact of climate change on potato production</td>
<td>5 hours 20 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The climate smart technologies for potato value chain</td>
<td>Master trainers updated on climate smart techniques for potato</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Farmer Field and Business School (FFBS) approach in Potato value chain</td>
<td>Sustainability and Effectiveness of Extension Approaches</td>
<td>FFBS methodology understood by end-users</td>
<td>7 hours</td>
</tr>
<tr>
<td>3</td>
<td>Good Agricultural Practices (GAPs) and Food Safety Management System (FSMS)</td>
<td>Understanding Relationship Between climate change on field Operations and Productivity and determine presence of hazardous solids, organisms, pathogens and pollutants</td>
<td>Climate smart crop management practices for increased potato productivity identified and techniques for determining pollutants in food material explored and adopted in potato value chain</td>
<td>10 hours 20 minutes</td>
</tr>
<tr>
<td>4</td>
<td>Potato production niches and climatic requirements</td>
<td>Mapping non-traditional (lowlands) areas that are suitable for potato production</td>
<td>Potato niche in the respective counties identified and published</td>
<td>4 hours</td>
</tr>
<tr>
<td>5</td>
<td>Potato variety selection</td>
<td>Awareness on improved potato varieties</td>
<td>New improved varieties promoted</td>
<td>4 hours</td>
</tr>
<tr>
<td>No.</td>
<td>Course Title</td>
<td>Description</td>
<td>Duration</td>
<td></td>
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<td>-----</td>
<td>-----------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
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<tr>
<td>6</td>
<td>Seed potato production systems</td>
<td>Inadequate knowledge and skills on seed potato production Limited access to high quality seed potato Low adoption of improved climate smart potato varieties Limited involvement of SMEs in seed potato business Weak market linkages in seed potato business’</td>
<td>6 hours 55 minutes</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Climate smart agronomic practices in Potato production</td>
<td>Options for innovating increased potato production</td>
<td>4 hours</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Integrated Soil and water management practices in potato production</td>
<td>Understanding effect of climate change on soil fertility and potato nutrient requirement Potato water requirement and management</td>
<td>5 hours</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Potato Crop health</td>
<td>Management of pests, diseases and weeds in relation to climate change Emerging pests, diseases and weeds as a result of climate change Economic importance of pests, diseases and weeds identified Climate smart management of pest, diseases and weeds identified</td>
<td>5 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Potato harvesting and Post-harvest management</td>
<td>Potato Post Harvest Loses Storage technologies to reduce losses in quantity and quality</td>
<td>Proper harvesting techniques and storage facilities identified and promoted</td>
<td>2 hours 30 minutes</td>
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</tr>
<tr>
<td>11</td>
<td>Potato value addition</td>
<td>High rate of deterioration Limited value addition opportunities Better business opportunities of processed products</td>
<td>Post-harvest value addition Opportunities identified and prioritized Post-harvest value adding strategy developed</td>
<td>3 hours</td>
</tr>
<tr>
<td>12</td>
<td>Mechanization of potato production activities</td>
<td>Inefficient manual potato production practices Non availability of labor</td>
<td>Adaptation of mechanized operations of potato from crop establishment, field operations to harvesting and post-harvest handling Options of mechanization for increased yield availed to farmer groups.</td>
<td>5 hours</td>
</tr>
<tr>
<td>13</td>
<td>Potato farming business and marketing</td>
<td>Lack of understanding of operations of farm business Lack of knowledge in market intelligence</td>
<td>Farming business concept understood Potato enterprise and business plans developed Market assessment methods and tools identified Market assessment and potato Marketing plans developed</td>
<td>9 hours 15 minutes</td>
</tr>
<tr>
<td>14</td>
<td>Innovation Platforms, Gender mainstreaming in climate smart agricultural practices in Potato production and Policy</td>
<td></td>
<td></td>
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<td>----</td>
<td>-------------------------------------------------------------------------------------------------</td>
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<tr>
<td></td>
<td>Articulate how VMGs can draw benefits from potato value chain Options of employment opportunities in potato production Sites for information profiled at the county levels Lack of understanding of gender Lack of understanding on mainstreaming gender in potato production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Opportunities for marginalized groups identified and gains made Farmers get access to more information on potato production Climate smart gender concept understood Climate smart gender mainstreaming in potato production done</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 hours 30 minutes</td>
<td></td>
<td></td>
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</tbody>
</table>

| Total Duration | 75 hours 35 minutes |
SECTION 3: TRAINING DESIGN

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

1. Establishment of a team of facilitators

⇒ A Core Team of Trainers (CTT) trains county agricultural officers and private service providers as facilitators of a ToT course, who will train farmers. This is done using this manual and modules contained therein.

⇒ Each of the Master trainers will facilitate trainees to acquire knowledge and skills in facilitating Farmer Field and Business Schools (FFBS) through practical demonstrations.

2. Upscaling – This will be done by selecting lead farmers (LF) to be trained in facilitation skills. The LFs will acquire knowledge and skills in facilitating farmer-led field and business schools.

3.2 Partners and their roles
The partners envisioned in this training plan are:

1. **Core Team of Trainers** – Master trainers drawn from KALRO and Department of Agriculture facilitate initial training of ToTs. They also provide mentorship to trainers during the first year of Lead Farmers training. They should also be available in the evaluation of the first round of LF training.

2. **County Government Department of Agriculture** – Master trainers and their supervisors referred to as County Coordination Teams (CCT) to take the role of LF trainers, mentors and coordinators at sub-county level. They assist FFBS’s form of partnership with stakeholders for sustainability. They should also support LF’s form their network.

3. **FFBS Farmer Networks** - Association of FFBS Farmers in the target counties to take up farmer training and up-scaling in the future. FFBS 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 potato farmer groups

3.3 Training duration
The ToT course for Master trainers for the 14 modules in the potato value chain shall take a total of 74 hours 35 minutes. Programs and timetables will be developed and will cater for this.
3.4 Logic Design

The logic of design and flow of each module is that the facilitator, paying attention to the proposed methods and sessions guidelines, shall: (1) Introduce the module; (2) Draw out the participants’ expectations; (3) Relate participants’ expectations with module objectives or learning outcomes; (4) 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; (5) Review the module at the end using participatory approaches where one participant reads one summary message and its application; and, (6) Distribute the participants’ handouts.
SECTION 4: FACILITATOR GUIDELINES

4.1. Preparation of Training Materials
The training materials suggested requires adequate preparations and should be available before the actual training dates. In addition:

1. The facilitators should familiarize themselves and internalize the guidelines provided by this manual early enough.
2. The stationery required should be available within the training institution 3 days before the training. These include name tags, writing materials, paper punch and medium size box files for participants’ handouts filing.
3. Flip charts and good quality felt pens could be used interchangeably with LCD projections.
4. Visual aids like field equipment and tools should also be arranged in time before start of sessions.
5. 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.
6. Copies of the modules are distributed at the end of each module.

4.2. Preparation of training venues and sites
The training venue will include the training room and field demonstration sites.

1. Training Room – should have adequate space for 30 participants
2. Demonstration Site – ideally should be a 5-minute walking distance with at least 5 distinct plots for demonstration.

4.3. The trainees
The target trainees are agriculture extension officers with elaborate training background in agriculture and extension. The facilitator should not lecture but draw out and build on their knowledge, skills and experiences 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 facilitator will require a program that consists of the actual training modules and the corresponding days and time allocation (Annex 1).

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. Depending on time available, the facilitator can modify these training methods, but as a golden rule no presentation by the facilitator should take more than 30 minutes continuously; but should be separated by the other participatory training methods. Table 2 present a list of available training methods.
Table 2: Description of Training Methods

<table>
<thead>
<tr>
<th>Training Method</th>
<th>Description of method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plenary presentations</td>
<td>Use of PowerPoint or flip charts and plenary discussions in situations where knowledge and opinion or consensus is required</td>
</tr>
<tr>
<td>Group exercises, buzz groups, visits and demonstrations</td>
<td>To be considered where skills are an issue requiring sharing and trying</td>
</tr>
<tr>
<td>Case studies</td>
<td>To be used where there is need to view a problem objectively and allow free exchange of ideas</td>
</tr>
<tr>
<td>Role plays and problem-solving exercises</td>
<td>Plenary discussions have been considered as training methods where attitude is an issue</td>
</tr>
<tr>
<td>On-farm practical demonstration</td>
<td>To be considered where hand-on practical skills are acquired through sharing and demonstration</td>
</tr>
</tbody>
</table>

4.6 Planning Schedule and Guidance for ToT preparation
While planning for this training, the CTT leader should ensure that the activities in Table 3 are accomplished before the training.

Table 3: Duration of activities to be done before training

<table>
<thead>
<tr>
<th>Duration to Training</th>
<th>Activities to be Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Six weeks</td>
<td>Recruit master trainers, compose CTT, identify the practical demonstration sites.</td>
</tr>
<tr>
<td>Four weeks</td>
<td>Send out invitation letters to participants and special guests detailing purpose, venue and program. Follow up on demonstration sites. Brief CTT members.</td>
</tr>
<tr>
<td>Two weeks</td>
<td>Confirm names of participants; reproduce training materials for facilitators 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.</td>
</tr>
<tr>
<td>Four days</td>
<td>Confirm training sites preparedness, prepare sitting arrangements, and brief assistants.</td>
</tr>
<tr>
<td>One day</td>
<td>Arrange training room furniture, place materials, equipment and stationery on the tables. Arrange for the reception of trainees at venue proposed.</td>
</tr>
<tr>
<td>On the first day</td>
<td>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.</td>
</tr>
</tbody>
</table>
4.7 Evaluation of the Training

A half day has been allocated for planning for way forward and evaluation of the ToTs on the last day of the training. The evaluation strategy should take two approaches. The first being the individual trainees evaluate the trainers and the training content through evaluation forms without conferring to each other (Table 4). The evaluation forms are then collected and analyzed by the CTT members.

<table>
<thead>
<tr>
<th>Aspect / Module</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Climate change and climate smart agriculture</td>
<td></td>
</tr>
<tr>
<td>2. Farmer Field and Business School (FFBS) methodology</td>
<td></td>
</tr>
<tr>
<td>3. GAPs and food safety system (FSMS) and Hazard analysis critical control points (HACCP) plan</td>
<td></td>
</tr>
<tr>
<td>4. Potato production in niche areas and climate requirements</td>
<td></td>
</tr>
<tr>
<td>5. Potato variety selection</td>
<td></td>
</tr>
<tr>
<td>6. Seed potato seed system</td>
<td></td>
</tr>
<tr>
<td>7. Potato climate smart agronomic practices</td>
<td></td>
</tr>
<tr>
<td>8. Integrated soil fertility and water management in potato production</td>
<td></td>
</tr>
<tr>
<td>9. Crop protection and health management for potato</td>
<td></td>
</tr>
<tr>
<td>10. Potato post-harvest management</td>
<td></td>
</tr>
<tr>
<td>11. Potato value addition</td>
<td></td>
</tr>
<tr>
<td>12. Mechanization of potato production activities</td>
<td></td>
</tr>
<tr>
<td>13. Potato farming business and marketing</td>
<td></td>
</tr>
<tr>
<td>14. Innovation platforms, gender mainstreaming in climate smart agricultural practices in potato production and policy</td>
<td></td>
</tr>
</tbody>
</table>

The second evaluation is trainee’s group evaluation. They retreat to one room and elect a chair and a secretary. They are the asked 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 clarifications if any misunderstanding occurred but 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 ToT’s improvement.

4.8 Facilitators Training Notes and Reference Materials

4.8.1. List of potato publications

The detailed list of general reference materials is in Annex 2.

4.8.2 Guide on the use of the information

The trainers will be advised to issue farmers with at most 2 publications /handouts for each of the training sessions. This is because if they go away with 10 handouts, 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 handouts and 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 internet café.

Trainers will be advised to issue one potato growing manual to be accompanied by two other publications such as information sheets, brochures, factsheets, posters among others. With subsequent training modules, they can develop their collection of publications.
PART II: POTATO TRAINING MODULES

This part presents the content of 14 modules of training namely: Climate change and climate smart agriculture, Farmer Field Business School (FFBS) approach, potato production niche and climate requirements, Good Agricultural Practices (GAP) and Food Safety Management System (FSMS), potato variety selection, potato seed systems, potato climate smart agronomic practices, Integrated soil fertility and water management practices, integrated pest and disease management, harvesting and post-harvest management, potato value addition, mechanization of potato production activities, potato business and marketing, and Cross cutting issues (Innovation Platforms, Policy, gender mainstreaming and social inclusion).

All the modules will be divided into the following:

1. Introduction to the module
2. Module learning outcomes
3. Module target group
4. Module users
5. Module duration
6. Module summary
7. Facilitators’ guidelines
8. Participants’ handouts
MODULE 1
CLIMATE CHANGE AND CLIMATE SMART AGRICULTURE

1.1. Introduction
The impact of climate change and variability in agriculture, food systems and food security is a serious concern. Kenya’s agricultural production systems is highly impacted due to the low adaptive capacity and the high exposure to climate related risks. The major agricultural activities are prone to risks and uncertainties of nature, which is affected by climate change either in intensity, scope or frequency. Climate change is expected to modify risks, vulnerabilities and the conditions that shape the resilience of agriculture systems as well as introducing new uncertainties. Adoption of climate smart agriculture (CSA) through application of tools and technologies and effective communications of weather information reduces the negative impacts of climate change and enhances access to food security in a changing environment. Thus, there is need to mainstream suitable climate resilient technologies, innovations and management practices (TIMPs) to increase productivity, resilience to climatic shocks and mitigate the causes of climate change.

1.2. Module Learning Outcomes
By the end of the module the following outcomes should be achieved:
1. The concept of climate change and variability discussed and explained
2. Knowledge on the impacts of climate change and variability on agriculture and food security shared
3. Concept of CSA shared and explained
4. Future climate scenarios modelled and how to manage the climatic conditions projected and appreciated.

1.3. Module Target Group
These module targets agricultural extension service providers dealing directly with farmer groups at community level or community facilitators.

1.4. Module Users
This module is intended for use by master trainers who are members of the Core Team of Trainers (CTT) and Lead Farmers in the potato value chain target Counties. The facilitators using this module should thoroughly familiarize themselves with the participants’ handouts (training materials).

1.5. Module Duration
The Module is estimated to take about 5 hours 20 minutes.
## Module 1. Climate Change and Climate Smart Agriculture in potato value chain

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.6.1. Introduction to climate change and variability</strong></td>
<td>Plenary presentation</td>
<td>Projector</td>
<td>30 minutes</td>
</tr>
<tr>
<td></td>
<td>Group discussion</td>
<td>Laptop</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Case study videos</td>
<td>Videos</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plenary discussions</td>
<td>Flip charts</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Participants’ handouts</td>
<td></td>
</tr>
<tr>
<td><strong>1.6.2 Climate change adaptations/coping mechanisms</strong></td>
<td>Brainstorming</td>
<td>PowerPoint</td>
<td>20 minutes</td>
</tr>
<tr>
<td></td>
<td>Plenary sessions</td>
<td>Flip charts</td>
<td>10 minutes</td>
</tr>
<tr>
<td></td>
<td>Group discussions</td>
<td>Handouts</td>
<td>20 minutes</td>
</tr>
<tr>
<td><strong>1.6.3. Impacts of climate change and variability on agriculture and food</strong></td>
<td>Plenary presentation</td>
<td>Projector</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Case study videos</td>
<td>Laptop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plenary discussions</td>
<td>Videos</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flip charts</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Handouts</td>
<td></td>
</tr>
<tr>
<td><strong>1.6.4. Concept of Climate smart agriculture (CSA) in potato</strong></td>
<td>Plenary presentation</td>
<td>Projector</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>Case study videos</td>
<td>Laptop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plenary discussions</td>
<td>Videos</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flip charts</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Handouts</td>
<td></td>
</tr>
<tr>
<td><strong>1.6.5. Projected future climate scenarios affecting potato and how to manage</strong></td>
<td>Plenary presentation</td>
<td>Projector</td>
<td>40 minutes</td>
</tr>
<tr>
<td></td>
<td>Case study videos</td>
<td>Laptop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plenary discussions</td>
<td>Flip charts</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Handouts</td>
<td></td>
</tr>
<tr>
<td><strong>1.6.6. Module review</strong></td>
<td>Participants’ questions and comments</td>
<td>Module review</td>
<td>20 minutes</td>
</tr>
<tr>
<td></td>
<td>Facilitator’s summary</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>5 hours 20 minutes</strong></td>
</tr>
</tbody>
</table>
## Module 1. Climate Change and Climate Smart Agriculture in Potato value chain

### 1.7.1 Introduction and Levelling Expectations (40 minutes)

*(The facilitator should be able to introduce the topic of climate change by defining it, highlighting effects, causes and risks and climate smart agriculture and its important linkages in the achievement of KCSAP project objectives. Thereafter, present the module objectives.)*

### Learning Outcomes

- What factors exacerbate the impacts of climate change on the African continent?
- What are commonly observed climate change impacts in Africa?
- Explain the relationship between human activities and climate change, with emphasis on ecosystems and conservation
- Assess the impacts of human activities on climate and the impacts of climate change on ecosystem services and socio-economic systems
- Identify potential responses and solutions to climate change challenges, and assess their feasibility and potential effectiveness
- Apply appropriate communication strategies on climate change mitigation and adaptation to different types of audience

*(After plenary presentation on introduction to climate change, refer to the participants’ handouts 1.7.1 on introduction to climate change, causes, effects and risks and 1.7.2 on designs for coping mechanisms/adaptations.)*

*(The facilitator should then let the participants to brainstorm and select the coping mechanisms they would adopt for various farms.)*

<table>
<thead>
<tr>
<th>Session Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribute participants’ Handouts 1.7.1 1.7.1.1 Introduction to climate change, causes, effects and risks and 1.7.1.2 (Choice of coping mechanisms/adaptations) in this exercise.</td>
</tr>
</tbody>
</table>

### Group Exercise

- Plan for logistics to the farms
- Carry out the exercise cautiously/carefully with the participants
- Let the participant make presentations of process and let them critique each other.
- Summarize the exercise and give recommendations.

**Provide participants with flip charts and felt pens**

---

In your groups, choice of coping mechanisms/adaptation plans on the farm you have been allocated and explain the factors that you consider during choosing the coping mechanism plan.

After the field exercises have one group present their work as others contributes and discuss.
**Trainees’ expectation (20 minutes)**
The facilitator organizes the trainees into groups to come up with their expectations.

**Module Objectives (20 minutes)**
By the end of the training module the trainee should be able to:
- To define climate change and adaptations
- Define ‘climate smart agriculture’
- Describe and explain available climate smart crop management practices in potato production
- Project and explain the benefits of selected climate smart crop management practices in potato production

<table>
<thead>
<tr>
<th>1.7.2. Introduction to Climate Change and Climate Variability (1 hour 40 minutes)</th>
<th>Session guide</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(The facilitator proceeds to introduce the module basics of climate change)</em></td>
<td>PowerPoint presentation Plenary discussion Participants’ handouts</td>
</tr>
<tr>
<td>Plenary presentation (1 hour)</td>
<td></td>
</tr>
<tr>
<td>Basic terminologies used in the module (weather, climate, variability, adaptation, coping)</td>
<td></td>
</tr>
<tr>
<td>Climate change and climate variability</td>
<td></td>
</tr>
<tr>
<td>The causes of climate change</td>
<td></td>
</tr>
<tr>
<td>Climate risks impacting agriculture (40 minutes)</td>
<td></td>
</tr>
<tr>
<td>Proposed adaptation measures</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.7.3. Concept of Climate Smart Agriculture (CSA) (2 hours)</th>
<th>Session Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(The facilitator presents to the trainees the principles underpinning CSA and the link to deliverable of project objectives)</em></td>
<td>PowerPoint presentation Participants’ handouts Plenary discussion.</td>
</tr>
<tr>
<td>Plenary Presentation (45 Minutes)</td>
<td></td>
</tr>
<tr>
<td>Definition of the CSA approach and their characteristics</td>
<td></td>
</tr>
<tr>
<td>The three pillars of CSA (productivity, adaptation and mitigation)</td>
<td></td>
</tr>
<tr>
<td>Why CSA is needed</td>
<td></td>
</tr>
<tr>
<td>Plenary Discussion (45 Minutes)</td>
<td></td>
</tr>
<tr>
<td>Discussions on the CSA concept</td>
<td></td>
</tr>
</tbody>
</table>
### 1.7.4. Projected Future Scenarios that will Impact Productivity (40 minutes)

*The facilitator presents and leads the trainees in discussing future climatic projections focusing on rainfall and temperature which directly impacts on crop yields*

- PowerPoint presentation and plenary discussion (20 minutes)
- What are the long-term rainfall and temperature projections as impacted by climate change?
- Project impacts on food production and needed adaptation measures especially for potato

- Video presentation (20 Minutes)
- Short Video on showing projections of rainfall and temperature

### 1.7.5. Module Review (20 minutes)

*The facilitator leads the trainees in summarizing the key points discussed in the module*

- Let the trainees recall what they learned and discuss any issues that may arise.

### 1.8. Participant’s Handouts

Fact sheets on climate change

### References

2.1. Introduction to the module
This module is designed to train and expose trainees to the Farmer Field and Business Schools (FFBS) approach and concepts. In addition, practitioners of FFBS need to have knowledge of this methodology in order to transfer various Technologies, Innovations and Management Practices (TIMPs) in potato production to farmers. The trainees will thereafter facilitate farmers in the Common Interest Groups (CIGs) to learn by doing the available Technologies, Innovations and Management Practices (TIMPS) from a common plot of FFBS and then implement what they have learnt to their individual farms in order to meet the KCSAP project objective of increased productivity and building resilience to climate change. FFBS also empowers the learners with various skills in leadership, communication and agri-business. Since the methodology is participatory, it improves the learners’ observation skills and creates linkages with other value-chain players, thereby making potato production profitable and sustainable.

2.2. Module Learning Outcomes
By the end of the module the following outcomes should be achieved:
1. Farmer Field and Business School approach mapped with teaching and facilitation defined and explained to enhance clear understanding.
2. Trainees equipped with practical skills that help them feel informed and confident about their roles and ability to facilitate a participatory learning process.
3. Trainees empowered with knowledge and analytical skills to design simple experiments to test and select the best option to mitigate the constraints in potato value chain through applying the TIMPs.
4. Shift from the traditional focus to improving productivity towards farming business facilitated.

2.3. Module Target Group
This 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 and lead farmers.

2.4. Module Users
This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT) and lead farmers in the potato value chain target Counties. The facilitators using this module should thoroughly familiarize themselves with the participants’ handouts (training materials).

2.5. Module Duration
The Module is estimated to take 7 hours.
## Module 2.6 Farmer Field and Business School Approach

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6.1 Introduction, Climate setting, leveling of expectations and objectives.</td>
<td>Setting norms and group discussions on expectations</td>
<td>PowerPoint, LCD projector, Flip charts and mark pens</td>
<td>30 minutes</td>
</tr>
<tr>
<td>2.6.2 Overview of FFBS key activities</td>
<td>Presentations and plenary discussions</td>
<td>Pictorials, PowerPoint and LCD projector</td>
<td>1 hour 30 minutes</td>
</tr>
<tr>
<td>2.5.3 Introduction to Communication and communication skills</td>
<td>Presentation, group discussions and plenary</td>
<td>PowerPoint, LCD projector, Flip charts and felt pens</td>
<td>35 minutes</td>
</tr>
<tr>
<td>2.6.4 Facilitation and leadership skills</td>
<td>Presentation and plenary</td>
<td>PowerPoint and LCD projector</td>
<td>35 minutes</td>
</tr>
<tr>
<td>2.6.5 Organization and management in FFBS</td>
<td>Presentation and plenary</td>
<td>PowerPoint and LCD projector</td>
<td>2 hours</td>
</tr>
<tr>
<td>2.6.6 Developing FFBS Curriculum for the Potato value chain</td>
<td>Group discussion and presentation, and plenary presentation</td>
<td>PowerPoint, Projector, Flip charts and felt pens</td>
<td>1 hour 30 minutes</td>
</tr>
<tr>
<td>2.6.7 Module review</td>
<td>Discussions conclusions and way forward</td>
<td>Flip charts, PowerPoint presentations and LCD projector</td>
<td>20 minutes</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>7 hours</strong></td>
</tr>
</tbody>
</table>
### 2.7 Facilitators’ Guidelines to FFBS establishment and operations

#### 2.7.1 Introduction, climate setting Leveling Expectations and Objectives (30 minutes)

*(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 and leads in climate setting.)*

**Trainee introduction and climate setting**
Introduction of participants, setting training norms, formation of FFBS sub groups (Working groups) and trainees to share their expectations

**Plenary presentation on module Objectives**
The facilitator presents modules objective in PowerPoint

By the end of the module the trainee should be able to:
- Describe the concepts, characteristics, principles and plans of Farmer Field and Business School (FFBS) as a ‘learning by doing approach as it applies in potato
- Be able identify main differences between teaching and facilitation
- Be able to understand how to conduct agro ecosystems analysis (AESA) on the potato value chain enterprise
- Be able to know how to successfully lay participatory technology development (PTD) of the potato value chain TIMPs
- Be able to develop FFBS curriculum for the potato value chain

#### 2.7.2 Overview of FFBS key activities (1hour 30 minutes)

**Plenary presentation**
The facilitator takes the trainees through the main concepts and pillars of FFBS which includes:
- The definition of FFBS.
- Participatory technology development (PTD) for the Potato value chain TIMPS.
- Agro ecosystems analysis (AESA) of the Potato value chain.
- Concept of what they are.
- FFBS principle of Integrated production and pest management (IPPM).
- FFBS Business concept and opportunities in the Potato value chain stages.

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Session Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide checklist for introduction of trainees to help them build confidence in participation</td>
<td>• PowerPoint presentation on the overview of key activities in FFBS</td>
</tr>
<tr>
<td>• Summarize and display trainees expectations</td>
<td>• Assign roles to the sub groups</td>
</tr>
<tr>
<td>• Set norms and nominate leaders</td>
<td>• Plenary presentation on the Objectives of the FFBS training module</td>
</tr>
<tr>
<td>• PowerPoint presentation on the overview of key activities in FFBS</td>
<td></td>
</tr>
</tbody>
</table>
### 2.7.3 Introduction to Communication and Communication skills (35 minutes)

<table>
<thead>
<tr>
<th>Session guide</th>
<th>Group exercise to gauge the understanding of trainees on:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• what communication is,</td>
</tr>
<tr>
<td></td>
<td>• communication channels,</td>
</tr>
<tr>
<td></td>
<td>• Barriers to effective communication and</td>
</tr>
<tr>
<td></td>
<td>• how to effectively communicate</td>
</tr>
</tbody>
</table>

**Plenary presentation**
Communication and communication skills

| Group exercise and presentations on flip charts and PowerPoint presentation Handouts |

### 2.7.4 Facilitation and leadership skills (35 minutes)

<table>
<thead>
<tr>
<th>Session guide</th>
<th>Plenary presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Definition of Facilitation, facilitator and effective facilitation.</td>
</tr>
<tr>
<td></td>
<td>• Qualities of a good facilitator.</td>
</tr>
<tr>
<td></td>
<td>• Golden rules of facilitation.</td>
</tr>
<tr>
<td></td>
<td>• Roles and responsibilities of FFBS Facilitators.</td>
</tr>
<tr>
<td></td>
<td>• Difference between facilitation and teaching</td>
</tr>
<tr>
<td></td>
<td>• Definition of leadership</td>
</tr>
<tr>
<td></td>
<td>• Elements of leadership</td>
</tr>
<tr>
<td></td>
<td>• Types of leadership</td>
</tr>
<tr>
<td></td>
<td>• Characteristics of a good leader</td>
</tr>
</tbody>
</table>

| PowerPoint presentation on Facilitation and leadership skills Handouts |

### 2.7.5 Organization and management in FFBS (2 hours)

<table>
<thead>
<tr>
<th>Session guide</th>
<th>Plenary presentation on FFBS implementation framework in the FFBS steps;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Ground working.</td>
</tr>
<tr>
<td></td>
<td>• Training of facilitators.</td>
</tr>
<tr>
<td></td>
<td>• Establishing PTDs at the FFBS.</td>
</tr>
<tr>
<td></td>
<td>• Season long FFBS sessions.</td>
</tr>
<tr>
<td></td>
<td>• Evaluation of PTDs.</td>
</tr>
<tr>
<td></td>
<td>• Field days.</td>
</tr>
<tr>
<td></td>
<td>• Graduation.</td>
</tr>
<tr>
<td></td>
<td>• Establishment of lead FFBS.</td>
</tr>
<tr>
<td></td>
<td>• Follow ups.</td>
</tr>
</tbody>
</table>

| Handouts      | PowerPoint presentation Handouts                                      |

### 2.7.6 Developing FFBS Curriculum for Potato value chain (1 hour 30 minutes)

<table>
<thead>
<tr>
<th>Session guide</th>
<th>Plenary presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steps of participatory technology development on the potato value chain production</td>
</tr>
<tr>
<td></td>
<td>• Identify the major constraints to increased yields of Potato value chain production</td>
</tr>
<tr>
<td></td>
<td>• Ranking of constraints in order from highest.</td>
</tr>
</tbody>
</table>

| Group exercises on  | Pairwise matrix ranking of constraints and TIMPs in the potato value chain |

• Identify list of TIMPS to address the constraints
• Rank the TIMPS in order from the most preferred
• Develop PTD on the most preferred TIMP objective
• Decide on the parameters for AESA
• Develop FFBS curriculum using crop growth stage calendar for the potato value chain

**Group exercises**
• Constraint identification and ranking
• TIMPS options identification and ranking
• Identification of the growth stages of the value chain crop and development of FFBS training curriculum

<table>
<thead>
<tr>
<th>2.7.7 Module review (20 minutes)</th>
<th>Session guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Participants Questions and answers</td>
<td>• PowerPoint presentation, projector, flip charts, felt pens</td>
</tr>
<tr>
<td>• Facilitators Summary</td>
<td></td>
</tr>
<tr>
<td>• Guideline on FFBS potato action plans (Group discussions)</td>
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</tr>
</tbody>
</table>

**2.8 Participants’ handouts**

**References**
MODULE 3
GOOD AGRICULTURAL PRACTICES (GAPs) AND FOOD SAFETY MANAGEMENT SYSTEMS (FSMS)

3.1. Introduction
This module is designed for training and exposing trainees to good agricultural practices and food safety management system along the potato value chain.

Good Agricultural Practices (GAPs) are based on the principals of risk prevention, risk analysis, sustainable agriculture by means of Integrated Pest and Disease Management (IPDM) and Integrated Crop Management (ICM) to continuously improve farming systems. The food sector is faced with declining food safety, reduced food quality, requirements for sustainable farming practices and negative environmental impact from agricultural activities. Worker safety and health issues together with traceability requirements have become a major concern to consumers who require assurance of their safety while buying food from the markets. Good Agricultural Practices are of utmost importance in protecting consumer health by ensuring safety throughout the food chain. It is imperative to operate not only from the table but also upstream to include suppliers of inputs such as fertilizers, propagation materials, and crop protection agro-chemicals and all value chain players including providers of logistics and farm equipment. Good Agricultural Practices are therefore constitute a certification system for agriculture, specifying procedures that must be implemented to produce and supply food that is safe for consumers and wholesome, using sustainable methods.

Food safety, an essential condition for food quality, is based on the absence or occurrence of hazards that may create risks to human and animal health, within acceptable limits. Hazards are a common occurrence along food value chains that lack effective control measures. Hazards may be inherent in the seed due to ‘bad’ agronomic practices or introduced from other sources as food moves along the supply chain from the farm to fork continuum. Consequently, food safety risks such as food-borne diseases occur frequently thereby adding an extra burden of medication to the consumers.

Today, there is an increasing public concern on the negative environmental and health impacts of agro-chemicals (pesticides, growth regulators and mineral fertilizers) used in crop production as well as microbial pathogens and their toxins. It has therefore become necessary to control the occurrence of the hazards through the implementation of an effective Food Safety Management Systems (FSMS) through Hazard Analysis Critical Control Points (HACCP). This is a seven step management system which provides the framework for monitoring the total food chain to reduce the risk of foodborne illness and sometimes resulting to death. It is based on the systematic identification and assessment of various hazards and means to controlling them. This makes it more of a preventive, rather than a reactive tool that places the protection of the crops value chains from biological, chemical and physical hazards into the hands of food management systems which is designed to identify and control potential problems before they occur.
3.2. Module Learning Outcomes
By the end of the module the following outcomes should be achieved:

1. Good Agricultural Practices (GAP) on matters of food safety and quality along crop value chains defined and explained to enhance clear understanding.
2. Proper utilization of resources (water, soil, manure, fertilizers and other inputs) while optimizing environmental protection and conservation explained and demonstrated.
3. Worker safety and health within the potato production system enhanced.
4. Traceability in food safety and quality mapped and explained.
5. Need for legal safe food production as a moral market requirement explained.
6. Risks/hazards of food safety along the potato production chain identified.
7. Critical control point (CCPs) and critical limits (CLs) at different levels of crop production mapped and determined.
8. Preventive and corrective measures for the control of hazards identified and defined.

3.3. Module Target Group
This module targets agricultural extension service providers based at sub-county and ward level, lead farmers and all crops value chain players. It will also be useful for private extension service providers dealing directly with farmer groups at community level.

3.4. Module Users
This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT) and Lead Farmers in the crops value chain target Counties. The facilitators using this module should thoroughly familiarize themselves with the participants’ handouts (training materials).

3.5. Module Duration
The Module is estimated to take **10 hours 20 minutes**

3.6 Module Summary

<table>
<thead>
<tr>
<th>Session</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6.1 Introduction, objectives and levelling of expectations</td>
<td>• Groups to bring out expectations</td>
<td>• Module objectives</td>
<td>10 minutes</td>
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<tr>
<td></td>
<td>• Plenary presentation</td>
<td>• Marker pens</td>
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<td>• Flip charts</td>
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<td>• Projector</td>
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<td>• Laptop</td>
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<tr>
<td>3.6.2 Understanding what is GAP and its application in the potato value chains</td>
<td>• Plenary presentations</td>
<td>• Flip charts</td>
<td>1 hour</td>
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<tr>
<td></td>
<td>• Group work</td>
<td>• Marker pens</td>
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<tr>
<td></td>
<td>• Plenary</td>
<td>• Projector</td>
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<td></td>
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<td>• Laptop</td>
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<tr>
<td></td>
<td></td>
<td>• Pictorials/video clips</td>
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</tbody>
</table>
| 3.6.3 Discussion of what factors to consider when selecting a site for agricultural activities through Risk Assessment | • Group Work  
• Farm visit within training site  
• Group presentations | • Flip charts  
• Marker pens  
• Projector  
• Laptop  
• Pictorials/video clips  
• Data sheets | 1 hour |
|---|---|---|---|
| 3.6.4 Review of GAP requirements for audit and types of protocols possible | • Group work  
• Plenary presentations  
• Mock audit | • Data forms  
• Flip charts  
• Marker pens  
• Projector  
• Laptop  
• Pictorials/video clips  
• Data sheets | 1 hour |
| 3.6.5 Introduction to site selection | • Group work  
• Plenary presentations | • Flip charts  
• Marker pens  
• Projector  
• Laptop | 30 minutes |
| 3.6.6 GAP checklists and audit | • Group work  
• Plenary presentations  
• Mock audits | • Flip charts  
• Marker pens  
• Projector  
• Laptop | 1 hour |
| 3.6.7 Safe use of Pesticides and calibration of sprayers and nozzles | • Group work on nozzles  
• Rate of discharge  
• Safety guidelines | • Pictorials/video clips  
• Knapsacks sprayer  
• Measuring cylinders  
• Tape measure  
• Nozzles  
• Empty clean pesticide containers | 1 hour 30 minutes |
| 3.6.8 Understanding of food safety management system in potato value chains | • Brain storming  
• Plenary presentation  
• Group discussions | • Flip charts  
• Marker pens  
• Projector  
• Laptop,  
• Pictorials/video clips | 1 hour |
| 3.6.9 Determination of food safety risk/hazards in potato value chains (hazard analysis) | • Plenary presentation  
• Group discussions | • Projector  
• Laptop  
• Flip charts  
• Marker pens  
• Participants’ handouts | 1 hour 30 minutes |
3.6.10 Determination of critical control points (CCPs) and Critical limits (CLs) in crop value chain

- Plenary Presentation
- Group discussions
- Projector
- Laptop
- Flip charts
- Marker pens
30 minutes

3.6.11 Prevention and corrective measures for CCPs in potato value chain

- Plenary Presentation
- Group discussions
- Flip charts
- Marker pens
- PowerPoint projector
- Laptop
- Pictorials/video clips
1 hour

3.6.12 Module review

- Participants’ questions and comments
- Facilitator’s summary
- Participants’ handouts
- Module review
10 minutes

TOTAL

10 hours 20 minutes

3.7 Facilitator Guidelines to Good Agricultural Practices

3.7.1 Introduction and Levelling Expectations (30 minutes)

*The facilitator welcomes trainees to the sub-module on GAPs and introduces him/herself stating profile and experience of working with farmers.*

**Trainees’ introductions and expectations (10 minutes)**
The facilitator invites the trainees to state their expectations after brainstorming in their respective county groups

**Module Objectives (20 minutes)**
The facilitator presents module’s objectives in PowerPoint.

By the end of the module the trainees should be able to:
- Appreciate GAP’s on matters of food safety and quality along the potato value chain.
- Optimize utilization of resources (water, soil, manure, fertilizers, and other inputs), environmental protection and conservation.
- Enhance worker safety and health within potato production system.
- Map and implement traceability in food safety and quality along the potato value chain.

*Session Guide*

- Summarize trainees’ “Expectations” on a flipchart and make displays
- PowerPoint presentation
### 3.7.2 Understanding what is GAP and its application in the Potato value chains (1 hour)

_Facilitator leads discussions on understanding of GAPs and its relevance to actors in the potato value chain._

**Plenary Presentation**
- Understanding GAP in the context of potato production
- Explain the role of GAPs in safe and sustainable food production system for growers and consumers.
- Understanding GAPs as the key to high commodity market destinations

**Session Guide**
- Powerpoint presentation
- Participants handouts
- Group exercises

### 3.7.3 Discussion of what factors to consider when selecting a site for potato production activities through Risk Assessment (1 hour)

_Facilitator guides discussions on the key determinants of site suitability for agricultural activities._

**Plenary discussion**
- Factors to be considered in an agricultural site selection
- The need for documentation in a farm assurance system
- Types of mandatory farm records
- General guidelines to conservation agriculture (CA)

**Session Guide**
- Powerpoint presentation
- Participants handouts
- Plenary discussion

### 3.7.4 Review of GAP requirements for audit and types of protocols possible (1 hour)

_The facilitator leads the trainees in summarizing the key points discussed in the module._

**Plenary presentation**
- Methods and procedures required at on-farm level to obtain GAP certification in potato production.
- Good soil management practices (appropriate crop rotations, manure application)
- Careful management of water resources and efficient use of water for rain-fed potato production via irrigation.
- Selection of potato types and varieties to meet local consumer needs.
- Adoption of IPM practices to minimize the potential impact of pest control actions on workers, food, and environmental and health safety.
- Minimizing contamination at harvest, on-farm processing and storage.

**Session Guide**
- Powerpoint presentation
- Participants handouts
### 3.7.5 Introduction to Site selection (1 hour 30 minute)

*The facilitator introduces the various factors involved in site selection through Pictorials/video clips PPT’s and farm walk*.

**Plenary Presentation**
- Factors to be considered in an agricultural site selection
- The need for documentation in a farm assurance system
- Types of mandatory farm records
- General guidelines to conservation agriculture (CA)

**Session Guide**
- PowerPoint presentation
- Participants handouts

### 3.7.6 GAP checklists and Audit (30 minutes)

*Facilitator guides the trainees on self-assessment Internal audit and corrective measures for non-compliance*.

**Plenary Presentation**
- Need for mandatory records in GAPs
- Internal audit procedures
- Practical on mock audits
- Interpretation of audit reports
- Compliance and corrective actions

**Group Exercise**
- Groups audit a farm or a process within the training site
- Present audit results and verdict and corrective actions

**Session Guide**
- PowerPoint presentation
- Global GAP checklists
- Participants handouts
- Group exercise

### 3.7.7 Safe use of pesticides and calibration of sprayers and nozzles (30 minutes)

*The facilitator organizes the groups to identify level of knowledge on pesticide use and safety. Determination of less hazardous pesticides, fungicides and herbicides, quantities to apply and respective PHIs*

**Plenary presentation**
- Formation of groups for practical activities
- Guided knapsack calibration
- Different types of nozzles and their uses
- Pesticide safety

**Group Exercise**
- Practical session on how to handle different types of pesticides, fungicides and herbicides together with their calibrations

**Session Guide**
- PowerPoint presentation
- Pesticide containers
- Knapsack sprayers
- Nozzles
- Participant’s handouts
- Group exercise
### 3.7.8 Understanding Food Safety (1 hour)

*The facilitator should be able to introduce food safety system by defining it and sharing its benefits with the trainees.*

**Plenary Presentation**
- Overview of Food Safety Management Systems (FSMS).
- Why food safety is important in crops production systems.
- Risks to human/animal health due to chemical, biological and physical hazards exposure.
- Legal and market requirements for food safety practice.
- Food safety practices that reduce risks/hazards.
- Use of HACCP tool/system for monitoring potato production

#### List the responses on flip chart
- PowerPoint presentation
- Participant’s handouts

### 3.7.9 Determination of food safety risks/hazards (1 hour)

*(Facilitator should guide discussions on the steps of identification of food safety hazards FSMS).*

**Plenary Presentation**
- Explain the concept of risk identification (Hazard analysis) in crop production chain.
- Listing the types of hazards that cause illness or death.
- Determine and identify factors influencing likely occurrence/severity of hazards.
- List hazards alongside the possible control measures.
- Explain the concept in a flow diagram

**Group Exercise**
- Groups to identify major risk/hazards at points of crop production.
- Produce flow diagrams for the potato production.

**PowerPoint presentation**
- Participants handouts
- Group exercise

### 3.7.10 Determination of critical control points (CCP) in potato value chains (30 minutes)

*The facilitator introduces the topic on determination of critical control points (CCP)*

**Plenary presentation**
- Why is important to determine CCP in production chain (preventing, eliminating or reducing risks).
- How to monitor and measure CCP (point, step or procedure).

**PowerPoint presentation**
- Participants handouts
- Group exercise
- How to document CCP.
- How to establish critical limits (from standards or guidelines) for each CCP.

**Group Exercise**
- Groups to identify and establish critical control points and critical limits.

### 3.7.11 Prevention and corrective measures for CCP in potato value chains (1 hour)

*The facilitator introduces the topic on prevention and control of possible hazards.*

**Plenary presentation**
- Establishment of corrective actions against CCP
- Establish verification procedures for CCP
- Establish record-keeping and documentation procedures
- How to develop HACCP plan and Food safety tool kit for the potato value chain

**Group Exercise**
Groups to identify and establish corrective actions and verification procedures for potato value chain.

### 3.7.12 Module Review (30 minutes)

*The facilitator leads the trainees in summarizing the key points discussed in the module.*

**3.8. Participants’ Handouts**
- Good Agricultural Practices (GAP) hand book
- HACCP hand book for potato production
- Farm management and production hand book

**References**
3. Global GAP Version V
4.1 Introduction
This module exposes service providers, lead farmers and facilitators to the different types of production ecological conditions (altitudes, soils, AEZs and climate) suitable for potato production. Potatoes are mainly grown by smallholder farmers under rain-fed conditions. The production systems are guided by the size of the farm and purpose (For example for fresh market or contract farming where farmers produce for processing companies) and the market demand. There is need for the knowledge on the upcoming production areas and climatic conditions for increased productivity of potato.

4.2 Module Learning Outcomes
By the end of the module the following shall be the outcomes:
1. Importance of potato in Kenya’s economy outlined and explained.
2. Aspects of altitudes, soil types and soil characteristics for potato production outlined and explained
3. Climatic conditions (temperatures, rainfall and humidity) required for potato production outlined and explained.
4. Specific county agro-ecological zones for potato production explained.

4.3 Module Target Group
This module is intended for public agricultural extension providers in the potato chain target counties and service providers.

4.4 Module Users
This module is intended for use by master trainers who are members of the Core Team of Trainers (CTT) and lead farmers in the potato chain target counties. The facilitators using this module should familiarize themselves with the participants’ handouts (training materials).

4.5 Module Duration
The Module is estimated to take a minimum of 4 hours

4.6 Module Summary

<table>
<thead>
<tr>
<th>Module 4: Potato production niches and climatic requirements</th>
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</thead>
<tbody>
<tr>
<td><strong>Sessions</strong></td>
</tr>
<tr>
<td>4.6.1 Introductions and climate setting</td>
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</tbody>
</table>
### 4.6.2 Objectives and expectations

- Presentations (guide on group work)
- County group exercise (trainees enlist expectations)
- Plenary discussions to share expectations

### 4.6.3 Importance of potato in Kenya’s economy

- Presentations
- Plenary discussions

### 4.6.4 Potato production ecological/climatic requirements for optimal yields

- Presentations
- Plenary discussions

### 4.6.5 Potato production Agro-ecological zones (AEZs)- average yields, and constraints in the traditional and non traditional Counties

- Group work to identify potato production pockets in their sub-Counties/Counties
- Presentations
- Plenary discussions

### 4.6.6 Module review

- Discussions/conclusion and way forward

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Presentations (guide on group work)</td>
<td>30 minutes</td>
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<tr>
<td>County group exercise (trainees enlist expectations)</td>
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<tr>
<td>Plenary discussions to share expectations</td>
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<td>Flips charts</td>
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<td>Felt pens</td>
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<td>Laptop for PowerPoint Presentation</td>
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<tr>
<td>Presentations</td>
<td>40 minutes</td>
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<td>Plenary discussions</td>
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<td>Flips charts</td>
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<td>Felt pens</td>
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<td>Laptop for PowerPoint presentations</td>
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<td>Handouts (training notes)</td>
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<td>Presentations</td>
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<td>Plenary discussions</td>
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<tr>
<td>Group work to identify potato production pockets in their sub-Counties/Counties</td>
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<td>Presentations</td>
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<td>Plenary discussions</td>
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<tr>
<td>Discussions/conclusion and way forward</td>
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<td>Flip charts</td>
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<tr>
<td>Laptop for PowerPoint presentations</td>
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</table>

**Total**: 4 hours

### 4.7 Facilitator’s Guidelines

#### Module 4: Potato production and appropriate climatic requirements

##### 4.7.1. Introductions and climate setting (20 minutes)

*The facilitator welcomes trainees to the module on potato production and appropriate climatic requirements. They are then invited to introduce themselves and state their past or current involvement in potato production along the potato value chain.*

- Summarize the facilitator/trainees involvement in potato value chains
### 4.7.2. Objectives and expectations (30 minutes)

The facilitator invites the trainees to state their expectations and thereafter presents module objectives:

#### Expectations (15 minutes)
The trainees go into groups (for example county based) and list expectations.

#### Objectives (15 minutes)
By the end of the module the trainee should be able to:
- Define the importance of potato in Kenya’s economy
- Indicate and describe altitudes and soil types/characteristics for potato production
- Describe climatic conditions (temperatures, rainfall and humidity) required for potato production
- Explain specific county agro-ecological zones for potato production

- PowerPoint presentations
- Group exercise (listing and presenting expectations).
- Expectations lists kept for later reviewing

### 4.7.3 Importance of Potato in Kenya’s economy (40 minutes)

#### Plenary presentation (25 minutes)
- Origin of potato
- Why potato in Kenyan households
- Key counties producing potato in Kenya
- General potato production in Kenya

#### Facilitator’s guided discussions (15 minutes)
Questions/answers/comments

- PowerPoint presentation
- Distribute to participants handouts

### 4.7.4 Potato production ecological/climatic requirements (1 hour)

#### Plenary Presentation (45 minutes)
- Altitude and agro-ecological zones
- Climatic conditions (rainfall, temperatures and humidity)
- Soils (soil types, pH)

#### Facilitator’s guided discussions (15 minutes)
Questions/answers/comments

- PowerPoint presentation
- Distribute to participants Handouts (training materials)
### 4.7.5. Potato production AEZs (villages), average yields, and constraints in the target Counties (1 hour)

<table>
<thead>
<tr>
<th>Session Guide</th>
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</table>
| **Plenary Presentation (30 Minutes)**  
Facilitator guides in reviewing and discussing suitability map (county by county) |
| **Group work (15 minutes)**  
Trainees to bring out specific county or sub-county AEZs, land size, yields and constraints to potato production and present in the plenary:  
- Agro-ecological zones (AEZs) and % area suitable for potato  
- Average land/farm size under potato  
- Average yield per farm of potato  
- Constraints to potato production |
| **Discussions/presentations from the groups (15 minutes)**  
Let the trainees/groups share the group exercise outcomes |

### 4.7.6. Module review (30 minutes)

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<th>Session Guide</th>
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</table>

* (The facilitator leads the trainees in reviewing the module)  
Summary of the main points from the training (30 minutes)  
By the end of the module the trainee should be able to:  
- Objectives and expectations (review done on basis of the earlier listed objectives and expectations)  
- Potato production ecological/climatic requirements, potato production AEZs (villages) average yields, and constraints in the target Counties  
- Trainees indicate new thing(s) learned from the module. The results are recorded per county presented  
- Trainees pin-point the way forward issues. |

### 4.8 Participants’ handouts

- Ware Potato production Guidelines [2016]
- Ware Potato leaflets [2020]
- Potato fact sheets
- Potato Handbook
5.1. Introduction to the Module
This module exposes service providers, lead farmers and facilitators to the improved potato varieties, their uses and target area of production. The various potato varieties that have been released for different ecological areas and different uses. There are varieties for lowlands and high lands areas as well as drought tolerant varieties. These varieties are further grouped into categories such as white skinned and red skinned. In utilization, there are varieties for chipping, crisping, dehydration, freezing, and table consumption. However, farmers are not able to identify the varieties suited for their regions and their needs. There is therefore need to train farmer trainers in the target counties on the different potato varieties, their suitable areas of production and their end uses.

5.2 Learning Outcomes
By the end of the module the following outcomes should be achieved:
1. The potato crop described
2. The various improved potato varieties, their ecological areas of cultivation and their attributes and uses identified.
3. Appropriate variety for specific regions identified

5.3 Module Target Group
This module targets agricultural extension service providers based in potato target counties.

5.4. Module users
This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT) and lead farmers in the potato value chain target counties. The facilitators using this module should thoroughly familiarize themselves with the participants’ handouts (training materials).

5.5 Module Duration
The Module is estimated to take 4 hours
### Module 5. Potato Variety Selection

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
</table>
| 5.6.1. Introduction and Objectives Expectations | Plenary presentation Group discussions and presentation of expectations | • Flip charts  
• PowerPoint | 1 hour |
| 5.6.2. Introduction to various improved potato varieties, their ecological areas of cultivation and their attributes and uses. | • Group exercises to identify commercial potato varieties  
• Plenary presentations | • PowerPoint  
• Flip charts  
• Manila papers  
• Mark pens | 1 hour 30 minutes |
| 5.6.3 Appropriate potato varieties for specific regions | • Plenary presentation  
• Group exercises | • PowerPoint | 1 hour |
| 5.6.4. Module review | • Group exercises  
• Facilitator’s summary | • Participants’ handouts  
• Module review  
• Participants’ handouts  
• Ware potato production handbook | 30 minutes |
| **TOTAL** | | | **4 hours** |

### 5.7. Facilitators Guidelines

#### Module 5: Potato Variety Selection

**Introduction and levelling expectations**

**Introduction (20 minutes)**

*(The facilitator welcomes trainees to the module on potato varieties and introduces himself/herself by stating his/her profile and experience).*

The facilitator invites the trainees to introduce themselves and state their expectations.

**Module Objectives (10 minutes)**

*(The facilitator presents modules objectives)*

By the end of the module the trainee should be able to:

1. Describe the potato crop and its climatic and ecological requirements.

**Session Guide**

- Summarize trainees’ “expectations” and display.
- Distribute participants’ handouts
- Module objectives, Program
2. Identify the various improved potato varieties their ecological areas of cultivation and their uses.
3. Identify the varieties suited to the counties of interest.

### 5.7.2 Introduction to improved potato and their uses (1 hour)

*The facilitator should describe the potato crop, the facilitator should be able to guide the trainees in identifying the various potato improved varieties and their uses.*

**Group work (10 minutes)**
Ask trainees highlight and describe some of the potato varieties they know.

**Plenary Presentation (20 minutes)**
- What is potato?
- Improved potato varieties.
- Categories of potato varieties for crisping, chipping and table consumption

*Show trainees the photographs of each variety and the full description and its uses.*

### 5.7.3 Recommended potato varieties for the target counties (2 hours)

**Plenary Presentation**

- **Varieties for the target counties (30 minutes)**
  - Potato growing regions and the non-traditional regions which are being targeted for potato cultivation in Kenya.
  - Potato varieties suited for each county
  - County climate conditions for target county (lowlands and highlands)

**Group Exercises (30 minutes)**
Trainees discuss and come up with potato varieties in their counties

**Group Exercises (1 hour)**
*Ensure there is an established plot of all the potato varieties.*
- Visit the potato plot with the trainees and assist them identify and study the various varieties.
- After the field visit facilitate them to recall what they learned and discuss on any issue that may arise.
  (can also use potato plant samples for the various varieties).
### 5.7.4 Module review (30 minutes)

*The facilitator should be able to lead the trainees in reviewing the module.*

**Group exercise**

Summarize the main points of the training

Together with the trainees review the main points about improved potato varieties

- 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 potato varieties?
- What questions do you still have about identification of potato varieties?

<table>
<thead>
<tr>
<th>Session Guide</th>
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</thead>
<tbody>
<tr>
<td>- The last participants’ handouts</td>
</tr>
<tr>
<td>- Summary of the main points from the module.</td>
</tr>
</tbody>
</table>

### 5.8. Participant’s handouts

- Ware potato production handbook [2018]
- Ware potato production guideline leaflets [2016]
- Potato handbook [2015]
6.1 Introduction to the module
This module is designed for training facilitators on seed potato production and distribution systems. It is necessary for trainees to have knowledge in the various seed systems and be aware of the benefits of each. This is with the view to improving utilization of certified seed potato; and be able to assist farmers to take advantage of measures to improve quality of seed potato on farm. One of the key challenges in increasing ware potato production is limited access to and inadequate supply of good quality seed potato and therefore farmers continue to recycle seed potato from previous harvests, obtain seed potato from neighbors or the market. In addition, effects of climate change such as drought increases production costs through irrigation and buildup of seed-borne pests. Also, high precipitation encourages disease outbreaks such as soft rots and late blight which makes seed production difficult ultimately leading to seed shortage. Conventional seed sources satisfy less than 10% of national demand for seed. The gap in seed demand is met by the informal seed sources. Such sources do not assure quality and often contribute to either spread or buildup of seed borne diseases that make farming unsustainable in the long run.

There is therefore need to consider the merits of widespread adoption of use of good quality seed potato which is produced and delivered to farmers through conventional seed supply channel as well as innovative delivery mechanisms that align to current potato farming realities in Kenya.

6.2 Module Learning Outcomes
1. By the end of the module participants should be able to:
2. List characteristics of a good seed production and delivery system
3. Guide the production of certified seed potato
4. Facilitate the establishment of satellite seed potato production centres
5. Facilitate farmers to adopt proper on-farm seed quality management practices

6.3 Module Target Group
These module targets agricultural extension service providers based at sub-county and ward levels. It will also be useful for private extension service providers.

6.4 Module duration
The Module is estimated to take 6 hours 55 minutes

6.5 Module users
This module is intended for use by master trainers who are members of the core team of trainers (CTT) and Lead Farmers in the potato value chain target Counties. The facilitators using this module should adequately familiarize themselves with the participants’ handouts (training materials).
## Module 6: Seed Potato Production And Delivery Systems

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
</table>
| 6.6.1. Introduction and levelling of expectations | Buzz Presentation | • Module objectives  
• Marker pens, flip chats  
• PowerPoint | 20 minutes |
| 6.6 2. Introduction to seed potato production and delivery systems | Brainstorming  
Plenary presentation | • Flip charts  
• PowerPoint  
• Participants’ handouts | 20 minutes  
10 minutes |
| 6.6.3. Requirements for certified seed potato production | Plenary presentations  
Group Discussions and presentation | • PowerPoint  
• Participants’ handouts | 20 minutes  
30 minutes |
| 6.6.4 Tissue culture system | Plenary presentations  
Group Discussions and presentation | • PowerPoint  
• Participants’ handouts | 20 minutes  
10 minutes |
| 6.6.5 Aeroponics system | Plenary presentations  
Group Discussions and presentation | • PowerPoint  
• Participants’ handouts | 20 minutes  
20 minutes |
| 6.6.6 Mini-tuber production | Plenary presentations  
Group Discussions and presentation | • PowerPoint  
• Participants’ handouts | 20 minutes  
10 minutes |
| 6.6.7 Satellite seed potato production | Plenary presentations  
Group Discussions and presentation | • PowerPoint  
• Participants’ handouts | 60 minutes  
40 minutes |
| 6.6.8 Mechanisms for improvement of quality Seed management in the seed delivery systems | Plenary presentations  
Group Discussions and presentation | • PowerPoint  
• Participants’ handouts | 10 minutes  
20 minutes |
| 6.6.9 Practical session on field operations | Simulation exercise  
Discussions of the exercise | • Farm at training site  
• Participants’ handouts | 45 minutes  
20 minutes |
| 6.6.10 Module review | Participants’ questions and comments  
Facilitator’s summary | • Participants’ handouts  
• Module review | 20 minutes |
| **TOTAL** | | | **6 hours 55 minutes** |
6.7 Facilitators Guidelines

Module 6. Seed Potato Production systems

<table>
<thead>
<tr>
<th>6.7.1. Introduction and Levelling Expectations (20 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(The facilitator welcomes participants to the module seed production and introduces him/herself stating his profile and experience of working with farmers).</em></td>
<td>Summarize participants’ “expectations” on a flipchart and make displays.</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

*The facilitator invites the participants to state their expectations.*

**Module Objectives**
*(The facilitator presents modules objectives)*

The objective of this module is to:
- Equip the participants with knowledge on seed potato production and delivery systems.
- Instruct on certified seed potato production.
- Equip trainees with skills field seed potato production and establishment of satellite seed potato production.
- Equip the trainees with strategies of on farm seed quality management.

<table>
<thead>
<tr>
<th>6.7.2 Introduction to Seed Potato production and delivery systems (30 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(The facilitator should be able to introduce seed production and delivery systems by defining and sharing benefits of each).</em></td>
<td>List the responses on flip chart</td>
<td>20 minutes</td>
</tr>
</tbody>
</table>

Start a discussion by asking participants “What is your understanding of seed potato production and delivery systems”?

- PowerPoint presentation.
- Summarize the definitions.
- Types of seed production and distribution systems.
- Benefits of certified seed potato.

Distribute participant handout Definition, of seed quality and seed systems; Share a link to Potato Variety Catalogue;
## 6.7.3 Requirements for certified Seed potato production (50 minutes)

(The facilitator should be able to help the participants to understand necessary requirements for registration of certified seed potato producers. It is advisable for the KEPHIS staff to co-facilitate this session).

- **PowerPoint presentation.**
- **Overview of the formal seed production system.**
- **Technologies in seed potato production.**

(The facilitator should then let the participants to brainstorm in plenary and highlight the advantages and disadvantages of each technology).

Entrepreneurs with established infrastructure should be encouraged to exploit new innovations including tissue culture propagation and rooted apical cuttings.

- **Requirements- PowerPoint presentation.**
- **To be registered as a seed merchant, one has to fulfil the conditions of the seed regulations of seed and Plant Varieties Act (Cap 326).**
- **Knowledge of the seed regulations.**
- **Have sufficient land for production and rotation.**
- **Provide cropping history of the land.**
- **Personnel with agricultural training background.**
- **Infrastructure (store, sorting and grading space, record keeping documentation system).**
- **Pay registration fees.**
- **The choice of variety (agreement with breeder to allow for commercialization of variety).**

**Buzz- group work**

(The facilitator should then let the participants to brainstorm in a group work to do costing of certified seed potato production on 1 acre).

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribute Participants’ handouts:</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Share a link to seed potato production and certification guideline; Requirements for registration as a seed grower Soft copy of Seed and Plant Varieties Act (Cap 326): Various registration forms and a schedule of KEPHIS fees related to seed potato production SR1 (application for registration as seed merchant); SR2 (Seed merchant Certificate); SR3 (application for registration as seed grower); SR4 (certificate of seed grower); SR5 (application for seed inspection); SR6 (field inspection result)</td>
<td>30 minutes</td>
</tr>
<tr>
<td>6.7.4 Tissue culture system</td>
<td>Session guide</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>• PowerPoint presentation.</td>
<td></td>
</tr>
<tr>
<td>• Overview of tissue culture system.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6.7.5 Aeroponics system</th>
<th>Session guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>• PowerPoint presentation.</td>
<td></td>
<td></td>
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<tr>
<td>• Overview of the aeroponics system.</td>
<td></td>
<td>40 minutes</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>6.7.6 Mini-tuber production system</th>
<th>Session guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>• PowerPoint presentation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Overview of the mini-tuber production system.</td>
<td></td>
<td>30 minutes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6.7.7 Satellite Seed Potato production (1 hour 40 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>(The facilitator should be able to help the participants to understand the concept of satellite seed potato production).</td>
<td></td>
<td></td>
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<tr>
<td>• PowerPoint presentation.</td>
<td></td>
<td></td>
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<tr>
<td>• Satellite seed potato bulking.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Resource planning for production, technical aspects of seed potato production.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Inspection steps towards certification and gross margin analysis.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(The facilitator should enumerate and expound on the elements of a functional satellite seed production system)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Essential elements for establishment of a satellite bulking site- PowerPoint presentation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Selecting suitable target sites.</td>
<td></td>
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<tr>
<td>• Characterizing the selected sites.</td>
<td></td>
<td></td>
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<tr>
<td>• Identifying target seed producers.</td>
<td></td>
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<tr>
<td>• Enhancing capacity of seed producers.</td>
<td></td>
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<tr>
<td>• Contracting community seed producers.</td>
<td></td>
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<tr>
<td>• Specifying roles of stakeholders in community seed production (farmers, researchers, extension workers, CBOs, KEPHIS).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to the participants’ handouts on requirements for registration as a seed producer and protocol for establishment of a satellite seed production site).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Key steps in setting-up a satellite seed bulking center.</td>
<td></td>
<td></td>
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<tr>
<td>• Sensitization of county staff.</td>
<td></td>
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<tr>
<td>• Recruitment of potential seed producers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distribute participants’ handouts on protocol for establishment of a satellite seed bulking site;</td>
<td></td>
<td>30 minutes</td>
</tr>
</tbody>
</table>
- Training of recruited seed producers.
- KEPHIS Registration as merchant.
- Site identification, sampling for BW, PCN and Black Leg.
- Acquisition of inputs including from a registered seed potato grower.
- Establishment of potato seed crop.
- KEPHIS Registration, inspection and certification of potato seed crop.
- Harvesting, grading, lot inspection of potato seed.
- Packaging, labelling, sealing and marketing.

<table>
<thead>
<tr>
<th>6.7.8. Mechanisms for improvement of Quality Seed Management in seed supply system (30 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>(The facilitator should be able to help the participants to understand the concept of on-farm seed potato quality management).</td>
<td></td>
<td>10 minutes</td>
</tr>
<tr>
<td>PowerPoint presentation on:</td>
<td>Distribute participants’ handouts:</td>
<td>20 minutes</td>
</tr>
<tr>
<td>- Introduce the concept of on-farm seed quality management.</td>
<td>Guidelines on establishment of seed plot protocol on QDS;</td>
<td></td>
</tr>
<tr>
<td>- Strategies for on farm seed quality management.</td>
<td>Guidelines on positive seed selection</td>
<td></td>
</tr>
<tr>
<td>- Benefits and disadvantages of on-farm seed quality management.</td>
<td></td>
<td></td>
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<tr>
<td>(The facilitator should be able to help the participants to list and elaborate strategies for on-farm seed potato quality management)</td>
<td></td>
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</tbody>
</table>

Strategies for on-farm seed quality improvement:
- Seed Plot/nursery technique.
- Positive selection.
- Quality Declared Seed (QDS).

The FAO/Swedish International Development Cooperation Agency (SIDA) Technical Conference on Improved Seed Production (Kenya, 1981) and at the Expert Consultation on Interstate Movement of Seeds (Rome, 1986) identified the concept of quality declared seed as a strategy to increase the availability of quality seed for the agricultural community.
# 6.7.9 Practical Session on Gross Margin Analysis of Certified Seed Potato production (1 hour 05 minutes)

(The facilitator should be able to organize and conduct resource planning and gross margin analysis for seed potato production).

We are now going to practically highlight the gross margin analysis of a seed potato enterprise, the following steps are important to follow as a way of preparation and executing the exercise:

- Determine the desired objective of the exercise.
- Put the participants into groups.
- Identify and gather the required materials and tools.

Discuss with the participants in their groups and give the assignment carry out the exercise cautiously/carefully with the participants.

Let the participant make presentations of process and let them critique each other.

Summarize the exercise and give recommendations

## Group Exercise

In your groups, list the production resources and inputs and their costs.

- Estimate the produce and estimated revenue.
- Perform the profit margin analysis.

After the field exercises, have one group present their work while others contributes and discuss.

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribute participants’ handouts 1.10.4 Gross margin analysis of seed potato production.</td>
<td>25 minutes</td>
</tr>
</tbody>
</table>

## 6.7.10 Module Review (20minutes)

- (The facilitator should be able to lead the participants in reviewing the module).
- Review together the main points about seed potato production and distribution.
- 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 seed potato production and distribution?
- What questions do you still have about seed potato production and distribution?
- This last Participants’ handout 1.10.6 summarizes the main points from the module.

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide participants with flip charts and felt pens</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Distribute handout 1.10.6 Module review</td>
<td>20 minutes</td>
</tr>
</tbody>
</table>
- Who can explain the first point - the message and its application? The second message?
- Thank you for joining us in this module, and we hope to see you in other modules in the future.

### 6.8 References


MODULE 7
CLIMATE SMART AGRONOMIC PRACTICES IN POTATO PRODUCTION

7.1 Introduction to the module
This module is designed for training facilitators of FFBS on potato crop management practices and their benefits in a dynamic farming environment. It is necessary that FFBS facilitators have knowledge in appropriate climate smart crop management practices so as to assist small scale farmers improve potato yields.

One of the key challenges in increasing potato production is limited and inadequate access to crop management practices that can result in better yields.

Farmers continue to plant potatoes the same way they do other crops in their farms such as maize, beans, garden peas or legumes, even with the threat of climate change. Further, majority of these farmers rely on information from their immediate neighbors especially if they seem to be having a ‘better’ looking potato crop compared to their own. Climate change effects like floods and drought have impacted negatively on potato production. There is therefore need to adopt climate smart crop management practices that will enhance productivity for a market led potato production system while reducing production risks and lowering greenhouse gas emissions. Different crop management practices are important in potato production and they will help to counter the challenges which have been mentioned above.

7.2 Module Learning Outcomes
By the end of the module the trainee should be able to:
1. Have knowledge on the effects of climate change on potato production.
2. Expose farmers to available climate smart crop management practices in potato production.
3. Train farmers to adopt selected climate smart production practices.

7.2 Module Target Group
These module targets public and public agricultural service providers

7.3 Module Duration
The Module is estimated to take 4 hours 5 minutes

7.4 Module users
This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT) and Lead Farmers in the potato value chain target Counties. The facilitators using this module should adequately familiarize themselves with the participants’ handouts (training materials).
### Module summary

#### Module 7: Climate Smart Crop Management Practises In Potato Production

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>7.6.1. Introduction and levelling of expectations</strong></td>
<td>Buzz Levelling expectations</td>
<td>Marker pens, flip chats PowerPoint</td>
<td>10 minutes</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tr>
<tr>
<td><strong>7.6.2. Introduction to climate change and its effects on potato production</strong></td>
<td>Presentation Brainstorming Plenary presentation</td>
<td>Flipcharts PowerPoint Participants’ handouts</td>
<td>40 minutes</td>
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<tr>
<td><strong>7.6.3. Climate smart field operations in potato production</strong></td>
<td>Presentation Brainstorming Plenary presentation</td>
<td>Flipcharts PowerPoint Participants’ handouts</td>
<td>50 minutes</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tr>
<tr>
<td><strong>7.6.4. Information and factors to consider in climate smart potato production</strong></td>
<td>Plenary presentations Group Discussions and presentation</td>
<td>PowerPoint Participants’ handouts</td>
<td>60 minutes</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>7.6.5. Practical Session on climate smart practices in potato production</strong></td>
<td>Discussions of the exercise Practical exercise</td>
<td>Farm at training site Rope, sprouted and unsprouted seed, fertilizer, jembe, pegs, tape measure Handouts</td>
<td>65 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>7.6.6. Module review</strong></td>
<td>Participants’ questions and comments Facilitator’s summary</td>
<td>Participants’ handouts</td>
<td>20 minutes</td>
</tr>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>4 hours 5 minutes</td>
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</tbody>
</table>

### 7.6 Facilitators Guidelines

#### Module 7: Climate Smart agronomic practices in potato production

<table>
<thead>
<tr>
<th>7.6.1 Introduction And Levelling of Expectations (10 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>(The facilitator welcomes participants to the module on climate smart crop management practices and introduces him/herself stating his/her profile and experience of working with farmers.)</td>
<td>Summarize participants’ “expectations” on a flipchart and make displays.</td>
<td>10 minutes</td>
</tr>
<tr>
<td>(The facilitator invites the participants to state their expectations).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Module Objectives**  
*(The facilitator presents modules objectives on PowerPoint)*

| Describe available climate smart crop management practices in potato production. Explain the benefits of selected climate smart crop management practices in potato production | Distribute participant handout : Module Objectives, risks and impact |

**7.6.2 Introduction to climate change and its effects on potato production (60 minutes)**  
*(The facilitator should define climate smart agriculture in PowerPoint).*

**Session Guide** | **Duration**
---|---
Group exercise: *The facilitator asks the trainees to highlight some of the climate risks and their impact on potato production).* | 20 minutes

Risks included on the PowerPoint presentation are.
- Potato yield instability.
- Decreased water availability
- Loss of soil fertility
- Deteriorated potato quality
- Damage of potato crop by potato frost
- Outbreak of pests and diseases in the fields

Effects include:
- Reduce yields
- Reduced tubers size
- Complete crop failure
- Increased disease and pest incidence
- High post-harvest losses
- Reduced income

**7.6.3 Climate smart field operations in potato production (50 minutes)**  
*(The facilitator should introduce climate smart crop management practices/field operations by defining them and sharing its benefits with the participants on power presentation).*

**Session Guide** | **Duration**
---|---
Discuss about Climate smart crop field operations. How climate smart crop field operations differ from the normal field operations?
- Climate smart field operations
- Dormancy breaking.
- Variety- drought/heat and disease resistant/ short dormancy. | List the responses on flip charts
Distribute participant handout on definition, benefits and importance of climate smart crop management practices. | 10 minutes 10 minutes
- Crop rotation.
- Weather forecasting application-KAOP.
- Planting time.
- Harvesting time.
- Soil conservation.
- Water resource management.
- Crop residue management.
- Conservation agriculture.
- Mechanization using small farm equipment.

**Plenary discussion**

*The facilitator should lead the participants in weather forecasting website-KAOP*

Climate smart field operations benefits include:

- Ensures early crop emergence and plant vigor.
- Climate smart potato management keep away pests and diseases.
- Ensures maximum utilization of the limited diminishing production resources such as land.
- Reduced destructive impact on the soil health, water and air while ensuring sustainable productivity.
- Assurance of high yields of acceptable quality.
- High economic returns on potato production hence increased household incomes.

<table>
<thead>
<tr>
<th>7.6.4 Information and factors to consider in climate smart potato production (40 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>(The facilitator should help the participants to understand necessary information required as well as the factors to consider in potato production from planting to harvesting on PowerPoint presentation).** Group Exercise:** Calculation of seed rate for seed potato required in an acre- seed rates <em>(The facilitator should then let the participants to brainstorm on seed rates)</em> Seed rate- Facilitator should give PowerPoint presentation</td>
<td></td>
<td>20 minutes 20 minutes</td>
</tr>
</tbody>
</table>
### 7.6.5. Practical Session Climate smart practices in Potato production (1 hour 05 minutes)

(Statement)  

**Session Guide**

- Highlight the important steps on potato field operations.
- Determine the desired objective of the exercise.
- Discuss with the participants in their groups and give the assignment.
- Carry out the exercise cautiously/carefully with the participants.
- Let the participant make presentations of process and let them critique each other.
- Summarize the exercise and give recommendations.

**Group Exercise:**

- Identifying challenges and mitigation measures  
  (The trainees should identify challenges in their area /county and how they plan to mitigate them selecting climate smart field operations that they would be suitable for adoption in their specific counties  
  (The facilitator will organize the trainees in groups)
  The trainees to identify challenges in their area /county and how they plan to mitigate  
  Trainees to design climate smart potato production from planting to harvesting and incorporate climate smart operations during the design of field operations suitable for their area  
  Each group presents their work as others contribute and discuss.

<table>
<thead>
<tr>
<th>7.6.6. Module Review (20 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
</table>
| (The facilitator should lead the participants in reviewing the module). | - Module review- PowerPoint presentation  
- 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 climate smart field operations/crop management practices? | 20 minutes |
What questions do you still have about climate smart potato crop management practices/field operations?

Were your expectations met?

**Module evaluation**
The facilitator will circulate a module evaluation form for the trainees to fill.

### References


8.1 Introduction to the module

Poor soil conditions and unreliable availability of moisture in most smallholder potatoes farming systems have been the main causes of low yields. Generally, crop yields have continued to decline over the years due to increased soil acidity, mining of nutrients not supplied in the applied fertilizers and poor soil structure caused by failure to use the available sources of organic matter. 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 availability for the potatoes production systems. Integrated Soil Fertility Management (ISFM), through conservation agriculture offers the best options for improving soil fertility in the advent of climate change adaptation.

Potatoes are mostly cultivated by smallholder farmers with minimal inputs. Drought management technologies to mitigate drought effects in potatoes 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 potatoes production systems.

This module introduces potatoes value chain service providers, lead farmers, public agriculture extension staffs and facilitators to the importance of integrated soil and water management practices for enhanced potato production.

8.2 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 from accredited laboratories in Kenya discussed and understood
3. Soil fertility and plant nutrition for increased potato productivity (4R Stewardship that includes nutrient source and application rates, timing and placement) explained and demonstrated.
4. Soil health and Integrated Soil Fertility Management (ISFM) for climate resilient cropping explained.
5. Knowledge on water harvesting technologies, water quality for potato production together with soil and water management acquired
6. Knowledge and skills for identifying temporary or permanent decline in the productive capacity of land and how to solve soil degradation challenges imparted.
7. Awareness on the occurrence of problematic soils and their management created.
8.3 Module Target Group and Categories
This module is intended for potatoes value chain service providers and County extension agents in the potato producing regions.

8.4 Module Users
This module is intended for use by Master Trainers who are members of the Core Team of Trainers (CTT). The facilitators using this module should be well conversant with the participant’s Handouts.

8.5 Module Duration
The Module is estimated to last 5 hours.

8.6 Module Summary

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training methods</th>
<th>Training materials</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8.6.1 Introduction, objectives and expectations</strong></td>
<td>-Personal introduction -Presentations -Plenary discussions</td>
<td>• Flip charts • Marker pens • PowerPoint presentation</td>
<td>30 minutes</td>
</tr>
<tr>
<td><strong>8.6.2 Soil composition, properties and health,</strong></td>
<td>-Presentations -Practical’s on how to conduct soil sampling and analysis</td>
<td>• Flip charts • Marker pens • PowerPoint presentation • Participants’ handouts</td>
<td>30 minutes</td>
</tr>
<tr>
<td><strong>8.6.3 Soil and plant tissue sampling and analysis</strong></td>
<td>-Presentations -Field demonstrations (Conduct soil and plant tissue sampling and analysis)</td>
<td>• Flip charts • Marker pens • PowerPoint presentation • Participants’ handouts</td>
<td>1 hour</td>
</tr>
<tr>
<td><strong>8.6.4. Soil fertility and plant nutrition</strong></td>
<td>Presentations Field demonstrations</td>
<td>• Flip charts • Marker pens • PowerPoint presentation • Participants’ handouts</td>
<td>30 minutes</td>
</tr>
<tr>
<td><strong>8.6.5 Soil health and (ISFM) for climate resilient cropping systems</strong></td>
<td>Presentations Field demonstrations</td>
<td>• Flip charts • Marker pens • PowerPoint presentation • Participants’ handouts</td>
<td>30 minutes</td>
</tr>
<tr>
<td><strong>8.6.6 Soil and water management and water harvesting technologies</strong></td>
<td>Presentations Field demonstrations</td>
<td>• Flip charts • Marker pens • PowerPoint presentation • Participants’ handouts</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>
8.6.7 Soil degradation and reclamation
- Presentations
- Field demonstrations
- Flip charts
- Marker pens
- PowerPoint presentation
- Participants’ handouts
- 30 minutes

8.6.8 Problematic soils and their management
- Presentations
- Field demonstrations
- Flip charts
- Marker pens
- PowerPoint presentation
- Participants’ handouts
- 30 minutes

8.6.9 Module review and discussion
- Discussions
- Flip charts
- 30 minutes

Total 5 hours

8.7 Facilitator’s Guidelines

Module 8: Integrated soil and water management practices in potato production

8.7.1. Introduction, Objectives and Expectations (30 minutes)

(The facilitator welcomes trainees to the module on sustainable water and soil fertility management practices for optimal production of dry in moisture stressed conditions. The trainees are then invited to introduce themselves and state their expectations).

Module Objectives (30 minutes)
(The facilitator presents modules objectives)

By the end of the module the trainee should be able to:

- Acquire knowledge on soil composition and what constitutes a healthy soil, including soil classification.
- Appreciate and discuss soil and plant tissue sampling for laboratory analysis, interpretation, and utilization of results from accredited laboratories in Kenya.
- Appreciate soil fertility and plant nutrition for increased crop productivity (4R Stewardship that includes Right source, Right application rates, Right timing and Right placement).
- Acquire knowledge on soil health and Integrated Soil Fertility Management (ISFM) for climate resilient cropping systems.
- Acquire knowledge on water harvesting technologies, soil and water management.
- Acquire knowledge and skills for identifying temporary or permanent decline of land productive capacity and provide various solutions to soil degradation.

Gain awareness on the occurrence of problematic soils and their management increased

- Summarize trainees’ “Expectations” and display.
- PowerPoint presentation
- Distribute participants’ handouts on Module Objectives and Training Program
### 8.7.2. Soil composition, properties and health (30 minutes)

*(The facilitator presents on soil composition, properties and health)*

**Plenary Presentation (20 minutes)**

Soil composition, properties and health
- Description of soil composition.
- Description of soil properties.
- Describe what soil health is all about.

**Discussion (10 minutes)**

Let the trainees recall what they learned and discuss any issues that may arise

### 8.7.3. Soil and plant tissue sampling and analysis (1 hour)

**Plenary presentation (30 minutes)**
- Overview of the soil sampling methods.
- Soil analysis results and interpretation.
- Overview of soil analysis results using available examples.
- Soil sampling guidelines.

**Practical exercise on soil sampling (30 minutes)**

Demonstration on soil sampling method

### 8.7.4. Soil fertility and plant nutrition (30 minutes)

**Plenary Presentation (20 minutes)**
- Potential role of different soil management techniques in addressing soil fertility challenges in potato smallholder farming systems.
- Integrated soil fertility management techniques.
- Soil management guidelines.

**Discussion (10 Minutes)**

Let the trainees recall what they learned and discuss any issues that may arise.

### 8.7.5 Soil health and (ISFM) for climate resilient cropping systems (30 minutes)

**Plenary Presentation (20 Minutes)**
- Soil health.
- Introduce integrated soil fertility management (ISFM).
- Soil health and ISFM for a climate resilient cropping system.
- Manure management, mulching, organic amendments and composting for increased use of organic manure for improving agricultural production.

**Session Guide**
- PowerPoint presentation
- Distribute participants’ handouts
- Brochures, leaflets and manual
- Conservation agriculture as a climate smart agriculture practice
- Potato intercrops and crop rotation as climate resilient cropping systems

**Discussion (10 Minutes)**
Let the trainees recall what they learned and discuss any issues that may arise.

### 8.7.6 Soil and water management and water harvesting technologies (30 minutes)

**Plenary Presentation (20 Minutes)**
- Principles of soil management for increased potatoes productivity.
- Methods of tillage systems that conserve water for potatoes use.
- Principles of soil fertility management for increased potatoes productivity.
- Methods of soil fertility management for increased potatoes productivity.

**Discussion (10 Minutes)**
Let the trainees recall what they learned and discuss any issues that may arise.

**Session Guide**
- **PowerPoint presentation**
- Distribute participants’ handouts
- Brochures, leaflets and manual

### 8.7.7 Soil degradation and reclamation (30 minutes)

**Plenary Presentation (20 minutes)**
- Overview of soil degradation and reclamation.
- Reclamation measures of degraded soil
- Identification of the causes of soil degradation
- Identification of reclamation measures of degraded soil

**Discussion (10 Minutes)**
Let the trainees recall what they learned and discuss any issues that may arise.

**Session Guide**
- **PowerPoint presentation**
- Distribute participants’ handouts
- Brochures, leaflets and manual

### 8.7.8 Problematic soils and their management (30 minutes)

**Plenary Presentation (20 minutes)**
- Problematic soils and their management.
- Soils with unsuitable biological properties.
- Soils with unsuitable chemical properties.
- Soils with unsuitable physical properties.

**Discussion (10 Minutes)**
Let the trainees recall what they learned and discuss any issues that may arise.

**Session Guide**
- **PowerPoint presentation**
- Distribute participants’ handouts
- Brochures, leaflets and manual
8.7.9. Module review (30 minutes)

*The facilitator leads the trainees in reviewing the module.*

Summarize the main points of the training review the main points together with the trainees.

Discuss with trainees about new things learned from this Module. Let them identify some of the problems and any other issues arising from the module.

<table>
<thead>
<tr>
<th>Session Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The last participants’ handouts</td>
</tr>
<tr>
<td>• Summary of the main points from the module on a flip chart and display</td>
</tr>
</tbody>
</table>

8.8. Participants’ handouts

- Soil Management Leaflets [KCEP-CRAL PAMHPLETS2019]
- OFRA Technical Training Manual
9.1 Introduction to the module
The module is designed for use in training facilitators of FFBS on crop protection, safe and effective use of pesticide. Rising temperatures has increased the incidence of pests and diseases in potato. Potato tuber moth reduces the tuber quality whereas aphids which increases the viral load in potato. High rainfall intensity leads to high diseases pressure like late blight and rotting of tubers. The principles and strategies of pests and disease management are important to prevent yield losses. This call for an understanding of climate smart Integrated Pests and diseases Management (IPM) practices. Majority of farmers and practitioners have no visual clue on determining disease symptoms from signs of nutrient deficiency. Developing the ability to identify disease symptoms will help to address problems in the field and to avoid high cost of production.

There is need to understand climate smart Integrated Pest and Disease Management (IPDM) for maintenance of crop health.

9.2 Module learning outcomes
By the end of the module the Trainees should be able to:
1. Train the farmer on climate change and its effect on pest and diseases
2. Train farmers to identify important potato pest and diseases and economic importance
3. Identify appropriate climate smart pest and diseases management practices.

9.3 Module Target group
This module targets public and private agricultural extension service providers. This module is intended for use by the potato Master Trainers who are members of the Core Team of Trainers (CTT) and Lead Farmers in Potato value chain target Counties. The facilitators using this module should adequately familiarize themselves with the participants’ handouts (training materials).

9.4 Module duration
The Module is estimated to take 5 hours 20 minutes.
### 9.5 Module summary

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.6.1. Introduction and leveling of expectations</td>
<td>Discussions, Presentation</td>
<td>Module objectives, Flip charts, felt pens</td>
<td>10 minutes</td>
</tr>
<tr>
<td>9.6.2. Climate change and its effect on pests and diseases management</td>
<td>Discussions, Brainstorming, Presentation</td>
<td>Flip charts and felt pens, PowerPoint images of pests and diseases, Participants’ handouts on potato pest and diseases</td>
<td>30 minutes</td>
</tr>
<tr>
<td>9.6.3. Potato pests and climate smart integrated management</td>
<td>Group discussions, Buzz exercise, Presentation</td>
<td>Flip charts, flash disks, felt pens, PowerPoint, participants’ handouts</td>
<td>35 minutes</td>
</tr>
<tr>
<td>9.6.4. Potato diseases</td>
<td>Brainstorming, Presentation</td>
<td>Flip charts, flash cards, felt pens, PowerPoint, colored pictures, handouts, Materials for testing for bacterial wilt</td>
<td>45 minutes</td>
</tr>
<tr>
<td>9.6.5. Climate smart integrated disease management</td>
<td>Presentation, Discussion and feedback</td>
<td>Notebooks, handouts, Flip charts and PowerPoint presentations</td>
<td>45 minutes</td>
</tr>
<tr>
<td>9.6.6 Weeds in potato production and their management</td>
<td>Brainstorming, Presentation, Discussion</td>
<td>Notebooks, handouts, Flip charts and PowerPoint presentations</td>
<td>1 hour 30 minutes</td>
</tr>
<tr>
<td>9.6.7 Module Review</td>
<td>Participants’ questions and comments, Facilitator’s summary</td>
<td>Participants’ handouts module review</td>
<td>20 minutes</td>
</tr>
</tbody>
</table>

**TOTAL** | 5 hours 20 minutes |
### Module 9: Potato Crop Health

#### 9.7.1 Introduction and Leveling Expectations (10 minutes)

*(The facilitator welcomes participants to the module Climate smart Integrated Pest and Disease Management and introduces him/herself by stating his/her profile and experience of working with farmers). The facilitator invites the participants to state their expectation for the module.*

**Module Objectives**
The facilitator highlights the module objectives. By the end of the module the trainees should be able to:

- Know how climate change influences pest and diseases occurrence.
- Identify important potato pests, and diseases damage caused, and economic importance on productivity.
- Recommend appropriate pest and disease management practices including IPDM and effective and safe use of pesticides.
- Identify the major weeds categories, broadleaved, grasses sedges and those parasitic to tomato.
- Describe the key features for weed classification
  - (a) Morphology- grasses, broad leaved and sedges (Cyperus spp).
  - (b) Lifecycle – annuals, biennials and perennials.
  - (c) Habitat –
    - (i) Terrestrial weeds: arable land weeds, fallow land weeds, lawn and pasture weeds.
    - (ii) Aquatic weeds.
  - (d) Mode of nutrient acquisition: free living or parasitic.
- Design an effective field surveillance plan for the major potato weeds.
- Design and implement an effective weed management plan, integrating suitable options including:

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>List the participants’ expectations on a flip chart and pin at a strategic place for reference during module review session</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>
Learn on the preventive, cultural, mechanical, biological, tolerant and herbicides only if necessary.

- Learn on safe use of herbicides:
- Design and implement an extension/training program on safe use of herbicides

<table>
<thead>
<tr>
<th>9.7.2 Climate change and its effect on pests and diseases management (30 minutes)</th>
<th>Session guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(Facilitator guides in, identification of pests and diseases, climate change influence on pests and disease occurrence, and challenges faced by farmers in managing them).</em></td>
<td>List the names of pests and diseases as they are mentioned and the challenges they pose</td>
<td>30 minutes</td>
</tr>
<tr>
<td>- Discussion;(PowerPoint presentation).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Most important pests and diseases of potato.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- How climate change influence pests and disease occurrence.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Present in PowerPoint images of common pests and diseases.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Ask participants to name the pests and diseases.</td>
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<td></td>
</tr>
</tbody>
</table>

**Plenary discussion**
Ask them to mention the challenges’ encountered by farmers when managing these pests and diseases

<table>
<thead>
<tr>
<th>9.7.3. Potato pests and climate smart integrated management (1 hour 20 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(The facilitator should guide the participants understand the economic importance of pests in potato production, how to identify their destructive stages and the integrated management practices available).</em></td>
<td>Handouts on pests life cycles</td>
<td>1 hour 20 minutes</td>
</tr>
<tr>
<td>PowerPoint presentation on:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic importance of pests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Aphids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Tuber moth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cutworms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Potato cyst nematodes (PCN)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- White flies</td>
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<td></td>
</tr>
</tbody>
</table>

*Expose the participants to the life cycle of the above Buzz exercise identification of destructive stages of pests*
With reference to participants’ handouts, ask participants to identify the destructive stage of the pest in 5 minutes and present in plenary.
Summarize in PowerPoint the pests’ life cycles and destructive stage and damage that they cause.

- Potato tuber moth
- Cutworms
- Nematodes
- Potato cyst nematodes (PCN)
- Root knot nematodes (RKN)
- Aphids
- White flies.

**Integrated Pest Management Practices**

*(The facilitator should present the integrated pest management concept then management options. Emphasize on the right stage of target for each management strategy and the relationship between the practice and other Climate Smart GAPs including crop rotation).*

<table>
<thead>
<tr>
<th>9.7.4. Potato diseases (45 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(The facilitator should present and lead in discussions on identification of causal organisms, spread of potato diseases, economic importance and management practices).</em></td>
<td><strong>PowerPoint</strong> or flip charts presentation</td>
<td><strong>List the diseases mentioned on flip chart</strong></td>
</tr>
</tbody>
</table>

**Presentation**

Disease causing organisms and their symptoms

- bacteria
- fungus
- viruses
- Transmission of pathogens.
- Diseases causing organisms (pathogens) can be spread by soil, wind, vectors or water.
- Group exercise identification of diseases and their symptoms.
- (Ask the trainees to mention the common potato diseases and how they manage them in their area).
- Allow them to present the answers written in their note books and list on flip chart.

Economic importance of potato diseases

The facilitator should initiate discussion on the economic importance of potato diseases.

- Loss of yields.
- Poor quality produce.
- Increased cost of production.
- Reduced income.
- Contribute chemicals overuse resulting health and environmental concerns.

**Bacterial Wilt**

Before the session starts, the facilitator can initiate the simple test for bacterial wilt as outlined in handout and continue with the presentation on bacterial wilt.
<table>
<thead>
<tr>
<th>Black leg of Potato</th>
<th>Make a summarized presentation on PowerPoint on the disease causal agents, signs/symptoms, sources of infection and management options.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato late blight</td>
<td>Make a summarized presentation on PowerPoint on the disease causal agents, signs/symptoms, sources of infection and management options. Different potato varieties have different resistance levels to potato late blight.</td>
</tr>
<tr>
<td>Ring rot</td>
<td>Make a summarized presentation on PowerPoint on the disease causal agents, signs/symptoms, sources of infection and management options.</td>
</tr>
<tr>
<td>Potato viruses</td>
<td>Make a summarized presentation on PowerPoint on the disease causal agents, signs/symptoms, sources of infection and management options.</td>
</tr>
</tbody>
</table>

Discussion—other diseases

(Discuss in plenary with the trainees these other potato diseases highlighting their symptoms, economic importance and IPM practices).
- Potato early blight.
- Black scurf.
- Verticillium wilt.
- Rhizoctonia.

Factors influencing occurrence and spread of diseases.
Buzz group work; ask the participant to list what they consider as the factors that influence:
- Occurrence of diseases.
- Spread of diseases.

After plenary discussion present and emphasize about the three key factors in the disease triangle (The facilitator should make a presentation on the factors that influence the occurrence and spread of potato diseases)
There are three factors that influence potato disease infections:

- The type of the disease-causing organism.
- Environmental conditions like moisture, temperature, humidity, wind.
- The nature, of the host plants themselves.

Disease causing agent and its host interact in time and space

- Emphasize the following on nature of the disease causing organism and mode of spread
- Viral diseases- seed, vectors.
- Bacterial diseases- seed, soil.
- Fungal diseases – wind, seed, runoff, volunteer crop, human beings and haulms.

9.7.5. Climate smart Integrated Disease Management (CSIDM) (45 minutes)

(The facilitator takes the participants through discussions on the need for IDM emphasizing on the dangers of accumulation and spread of diseases inoculum).

PowerPoint presentation

- Integrated pest and disease management (concepts, principles and components).
- IPDM combines the use of biological, cultural and chemical practices to control pests and diseases.

Session Guide | Duration
--- | ---
List on flip chart Challenges Opportunities as they are mentioned | 45 minutes
Refer back to the opportunities when summarizing this session List them as they are mentioned |
9.7.6. Potato Weeds and their Management (1 hour 30 minutes)

Analyses of critical factors in weed occurrence and their management and their impact on potato production (30 minutes)

(The facilitator should describe the impact of weeds on potato production and issues in their management) (20 minutes)

- Environmental conditions including humidity, temperature, soil pH and rainfall.
- Human influence/activities.
- Yield losses.
- Quality reduction.
- Herbicide and food safety challenges.
- Costs (financial, environmental, health).

Identification of weeds of economic importance that occur in potato crop grown in the fields, broad leaved, grasses, sedges and parasitic weeds (1 hour)

Present the following on PowerPoint slides and flip charts:

- 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.

Show photo/video on weeds, and discuss the content.

Present the following on PowerPoint slides and flip charts:

Management methods:

Mechanical

- Exclusion, prevention.
- Cultural practices.
- Biological control.
- Resistant varieties.
- Herbicides.

They are obtained as:

(1) Pre-emergences are applied on to the soil after field preparation and sowing before both crop and weed have emerged.

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribute handouts and photocard to participants on potato</td>
<td>1 hour 10 minutes</td>
</tr>
<tr>
<td>Arrange 1-2 days before training to take photos or put together weeds infesting potato. Arrange 1 day training to collect weeds before training and characterize them with participant to create for awareness</td>
<td></td>
</tr>
<tr>
<td>Distribute handouts and photocard to participants on parasitic weed infestation</td>
<td></td>
</tr>
<tr>
<td>Arrange 1-2 days before training to collect information on potato infested with parasitic weeds.</td>
<td></td>
</tr>
</tbody>
</table>
Post emergence are applied when both the crop and the weed are actively growing, these are divided into

(a) Selective: These will not harm the crop when applied

(b) Non selective, broad spectrum
- Integrated weed management (IWM); using two or more of most appropriate, case specific, combination of strategies

<table>
<thead>
<tr>
<th>9.7.7 Module Review</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitator allows the trainees to check whether module objectives have been achieved</td>
<td></td>
<td>20 minutes</td>
</tr>
</tbody>
</table>

9.8 References
10.1 Introduction to the module
This module is designed for training facilitators of postharvest management and value addition in skills that are useful in postharvest management practices, adding value, identifying and prioritizing value addition opportunities in potato value chain, and demonstrating how to develop a value addition strategy.

Potato farming in Kenya is practiced as a subsistence undertaking by small holder farmers with most producing potatoes without clear marketing strategies. Potatoes are bulky and highly perishable (easily deteriorate in quality) therefore if not handled properly can experience postharvest losses due to climate change. Postharvest handling due to poor handling and storage are reported to be in between 20-50 per cent from harvesting to utilization.

This often leads to low sales/prices for produce and hence reduced income thereby leaving the farmer with little for re-investing to the farm. There are opportunities in earning more income through proper post-harvest management practices (value addition). In potato producing areas farmers engage buyers in harvesting potatoes. The buyers then package and cart away the produce ready to market. This limits post-harvest enterprise development and hence is not sustainable, neither can it lead to enterprise growth. Farmers rarely understand how the market operates and thus produce with uncertainty. There is disconnect between production and marketing where most farmers believe their role ends when the produce matures. Selling of potatoes is done at the farm or at the farm gate. In most cases, potato farmers engage middle men who provide labor for harvesting and linking the produce to the market. These middlemen facilitate value addition through engaging in upstream value chains activities like sorting, grading, packaging, storage and bulking that should otherwise have been undertaken by the farmers. In the process, the middlemen earn more than the farmers.

Climate change has led to unpredictable weather patterns, shorter growing seasons, droughts, extreme temperatures, increased exposure to pests and diseases. This has resulted to poor quality tubers in the market. There is therefore need to adopt climate smart post-harvest management practices that will enhance quality for a market oriented potato production system while reducing production risks.

10.2 Module objectives
The facilitator presents modules objectives.
By the end of the module participants should be able to:
1. Understand climate smart post-harvest practices for potato.
2. Identify and prioritize value addition opportunities in the potato value chain.
3. Demonstrate how to develop a value addition strategy for the priority opportunities emphasizing on suitability and growth.
10.3 **Module Learning Outcomes**
1. By the end of the module the trainees should be able to:
2. Train farmers on climate smart post-harvest management practices for potato.
3. Appreciate available value addition opportunities in the potato value chain.

Able to train farmers on how to develop a value addition strategy for the priority opportunities emphasizing on suitability and growth.

10.4 **Module target group**
This module targets public and private agricultural extension service providers based in the Counties

10.5 **Model Duration**
The Module is estimated to take 3 hours 45 minutes.

10.6 **Module Summary**

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.6.1. Introductions and leveling of expectations</td>
<td>Buzz</td>
<td>Flip charts, pens masking tapes, cards PowerPoint Module objectives</td>
<td>10 minutes</td>
</tr>
<tr>
<td></td>
<td>Presentation</td>
<td></td>
<td>5 minutes</td>
</tr>
<tr>
<td>10.6.2. Introduction to post harvest management and value addition</td>
<td>Presentations</td>
<td>PowerPoint presentations and discussions Participants’ handouts Flip charts, pens, flash cards of different colours, cutters Presentations</td>
<td>20 minutes</td>
</tr>
<tr>
<td></td>
<td>Group exercise</td>
<td></td>
<td>20 minutes</td>
</tr>
<tr>
<td></td>
<td>Group presentations</td>
<td></td>
<td>15 minutes</td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.6.3. Simple value added analysis</td>
<td>Presentation</td>
<td>PowerPoint value added analysis Charts Participants’ handouts</td>
<td>25 minutes</td>
</tr>
<tr>
<td></td>
<td>Plenary discussion</td>
<td></td>
<td>15 minutes</td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td></td>
<td>15 minutes</td>
</tr>
<tr>
<td>10.6.4 Prioritizing opportunities in value addition</td>
<td>Presentations and discussions</td>
<td>List of products developed in sessions Checklist for prioritization Pairwise ranking tool</td>
<td>30 minutes</td>
</tr>
<tr>
<td></td>
<td>Group exercise/ranking</td>
<td></td>
<td>15 minutes</td>
</tr>
<tr>
<td></td>
<td>Plenary discussions</td>
<td>Flip charts</td>
<td>15 minutes</td>
</tr>
<tr>
<td>10.6.5. Value addition strategy development</td>
<td>Presentation</td>
<td>Flip charts</td>
<td>10 minutes</td>
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<tr>
<td>---------------------------------------------</td>
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</tr>
<tr>
<td>Focused group discussion</td>
<td>Participants’ handouts (sample charts)</td>
<td>15 minutes</td>
<td></td>
</tr>
<tr>
<td>Plenary presentation</td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>10.6.6 Module review</th>
<th>Participants’ questions and comments</th>
<th>Module review</th>
<th>15 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitator’s summary</td>
<td>A small ball for throwing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL** | | | **3 hours 45 minutes** |

### 10.7 Facilitator’s Guidelines

<table>
<thead>
<tr>
<th>Module 10: Potato harvesting and post-harvest management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10.7.1. Introduction And leveling of Expectations</strong></td>
</tr>
<tr>
<td>(Facilitator welcomes participants to the module postharvest management and value addition and introduces his/her-self by stating personal profile and experience of working with farmers).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>PowerPoint presentation</td>
<td>5 minutes</td>
</tr>
</tbody>
</table>

The facilitator invites the participants to write their “Expectations” on flip charts and display.

**Module Objectives**
The facilitator presents modules objectives.

**10.7.2. Introduction to potato Post-harvest management (55 minutes)**

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribute participants’ handouts on Post-harvest Management practices</td>
<td>20 minutes</td>
</tr>
</tbody>
</table>

(The facilitator should guide a discussion on the definition of post-harvest management and value addition, post-harvest management activities, benefits of value addition and the range of value-added products).

- Harvesting management practices of potato.
- Post-harvest management practices.
- Post-harvest practices in potato production and all activities from harvesting to utilization.
### Plenary Presentation

Facilitator poses questions to assess the level of participants’ understanding of post-harvest, post-harvest management activities.

- PowerPoint presentations on definitions of post-harvest, post-harvest management activities.
- PowerPoint presentations benefits of post-harvest management practices.
- PowerPoint presentations on various of products.

### 10.8 References


Handling and storage methods for fresh roots and tubers - [www.fao.org/3/x5415e/x5415e04.htm](http://www.fao.org/3/x5415e/x5415e04.htm)
11.1. Introduction to the Module
Potato utilization at household level is very low due to little knowledge on the various opportunities and recipes for value addition and product diversification for home consumption and small-scale businesses. Potato contains vitamins and minerals, as well as an assortment of phytochemicals, such as carotenoids and polyphenols. A medium-size 150 g potato boiled with the skin provides 27 mg of vitamin C (45% of the Daily Value (DV)), 620 mg of potassium (18% of DV), 0.2 mg vitamin B6 (10% of DV) and trace amounts of thiamin, riboflavin, folate, niacin, magnesium, phosphorus, iron, and zinc. The fiber content of potato skin (2 g) is equivalent to that of many whole grain breads, pastas, and cereals. In terms of nutrition, potato is best known for its carbohydrate content (approximately 26 g in a 150 g medium potato).

Generally, potato traditional recipes which are boiling and stewing are less appealing to the youth and children. Further, potato starch is classified as ‘resistant starch’ which is not easily and quickly broken down by digestive enzymes produced by our bodies. Instead the starch travels to the colon/large intestines where it provides starch for microorganisms thereby boosting the health of your guts. It is therefore envisaged that promotion of value addition technologies and value-added products will not only enhance adoption, production and home consumption, but also improve the livelihoods of smallholder resource-poor farmers through sustainable income generation. This module is therefore designed to equip extension staff at the County level with relevant knowledge on value addition options available for potato and skills for training the farmers.

11.2 Module Learning Outcomes
By the end of the module, the trainees should:
1. Acquire knowledge on the nutritional composition of potato, impact of potato consumption on human health and sustainable income.
2. Have constraints in value addition and consumption of potato, and suggested solutions identified.
3. Have enhanced knowledge on recipes for potato value added products.
4. Identify and prioritize value addition opportunities in the potato value chain.

11.3 Module Target Group
This module targets County agricultural extension staff, private extension service providers, home economists and food utilization extension staff.

11.4 Module Users
The facilitators using this module should be well conversant with the participants’ handouts. This module can be used by Master Trainers who are members of the Core Team of Trainers (CTT).

11.5 Module Duration
The Module is estimated to take a duration of 5 hours, 30 minutes
### Module 11. Potato value addition

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training Methods</th>
<th>Training Materials</th>
<th>Time</th>
</tr>
</thead>
</table>
| **11.6.1. Introduction, Objectives and Expectations** | • Plenary presentation  
• Plenary discussions | • Flip charts  
• Projector  
• Laptop | 30 minutes |
| **11.6.2 Role of potato as a food and nutrition security crop** | • Plenary presentation  
• Plenary discussions | • Flip charts  
• Marker pens  
• Masking tapes/Flip chart holders | 30 minutes |
| **11.6.3. Nutritional composition of potato and its role in human health** | • Demonstration  
• Group exercise | • Potato and its products | 1 hour |
| **11.6.4. Constraints in value addition** | • Group exercise  
• Plenary presentations | • List of value-added products for potato-checklist for prioritization  
• Pair-wise ranking tool  
• Flip charts  
• Marker pens  
• Masking tapes or flip chart holders | 1 hour |
| **10.6.5 Potato-based value added products** | • Plenary presentations  
• Group discussions | • Potato and its products | 2 hours |

- **Value added potato tuber**
  - Pre-cooked potato product (15 min cooking potato meal)
  - Potato flours
  - Potato recipes (chips, porridge, cookies, cakes, chapatti, mandazi, stews, crisps)
### 11.7. Facilitators Guidelines

#### Module 11. Potato value addition

<table>
<thead>
<tr>
<th>10.7.1 Introduction and levelling of expectations and objectives (30 minutes)</th>
<th>Session Guide</th>
</tr>
</thead>
</table>
| **Introduction and Module Objectives (5 minutes)**  
*The facilitator welcomes trainees to the module on value addition of potato.*  
The facilitator presents modules objectives. | • Handouts  
• Program  
• Notebooks  
• pens  
• Use PowerPoint  
• Flip charts  
• Marker pens  
• Masking tapes/flip chart holders  
Summarize trainees’ “expectations” and display on flip chart/board. |
| **Module Objectives**  
By the end of the module the trainee should:  
• Understand the role of potato as a food and nutrition security crop.  
• Have knowledge on nutritional composition of potato, impact of consumption on health, food security and income.  
• Understand the constraints in value addition and consumption of potato, and suggested solutions.  
• Know the recipes for potato value added products.  
• Identify and prioritize the value addition opportunities in potato value chain.  
• Gain knowledge on making potato-based value-added products.  
**Expectations (15 minutes)**  
The facilitator should guide the trainees in stating their expectations based on the objectives | |
| 11.7.2 Role of potatoes as a food and nutrition security crop | Session Guide |
| **Plenary presentation (30 minutes)**  
PowerPoint presentation highlighting the critical elements:  
• Micronutrient malnutrition cases in Kenya.  
• Dietary nutrient requirements (focusing on VMGs). | • Use PowerPoint  
• Handouts  
• AIV manual  
• Recipe books  
• Sample vegetables and other processing ingredients |
| **Group exercises (30 minutes)** | |
### 11.7.3. Constraints in value addition and consumption of potato plus suggested solutions (1 hour 30 minutes)

**Group work (45 minutes)**
Groups discuss the constraints in potato value addition and consumption.

**Plenary presentation (45 minutes)**
Overview of constraints in value addition and consumption of potato.

### 11.7.4 Potato-based value-added products (1 hour 30 minutes)

**Plenary presentation (30 minutes)**
- Overview of potato-based value-added products.
- Meaning of value addition.
- Requirements for value addition of potatoes.
- Potato based value added products, sensory evaluation of the products.

**Practical exercise (1 hour)**
- Demonstration on formulation of potato-based products.
- Practical on sensory evaluation of potato value added products.

**Group Exercise (30 minutes)**
Allow trainees to raise any issues on potato value added products ranking and discuss them.

### 11.7.6 Training review (30 minutes)

*The trainer leads the trainees in reviewing he module*
Review the main points about potato value addition together with the trainees.
- 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 potato value addition?
- What questions do you still have about potato value addition?

### Session Guide

#### 11.7.3. Constraints in value addition and consumption of potato plus suggested solutions (1 hour 30 minutes)
- Leaflets
- PowerPoint presentation manuals

#### 11.7.4 Potato-based value-added products (1 hour 30 minutes)
- Handouts
- Potato manual
- Brochures
- Leaflets
- Recipes
- Sensory evaluation forms
- Assorted value addition equipment and ingredients

#### 11.7.6 Training review (30 minutes)
Summary of the main points from the module.

### 11.8. Participants’ Handouts
- Potato Manual
- Pamphlets, leaflets.
- Recipe books
12.1 Introduction to the module
Agricultural mechanization enhances production, productivity and profitability in agriculture by achieving timeliness of farm operations. It comes along with precision in metering and placement of inputs, reducing susceptibility to input losses, increasing utilization efficiency of inputs (seed, chemical, fertilizer, irrigation, water among others), reducing unit cost of production, enhancing profitability and competitiveness in the cost of operation. It also benefits conservation of agricultural produce and by-products from qualitative and quantitative damages; enables value addition and establishment of agro processing enterprises for additional income and employment generation from farm produce. Agricultural mechanization is one of the important inputs that can revolutionize potato farming in Kenya especially when applied to planting, weeding, pest control, harvesting and post-harvest activities.

12.2 Module Learning outcomes
By the end of the module section the following outcomes should be achieved:
1. Climate smart tillage options identified and explained.
2. Tractor mounted planter described and explained.
3. Use of pest control implements and tools demonstrated.
4. Harvest equipment identified and demonstrated.
5. Grading machines and equipment identified and demonstrated.

12.3. Module Target Group and Categories
This module is intended for private service providers and County public extension agents.

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

12.5. Module Duration
The Module is estimated to take a minimum of 4 hours.
### Module 12. Mechanization of potato production activities

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training methods</th>
<th>Training materials</th>
<th>Duration</th>
</tr>
</thead>
</table>
| 12.6.1 Introduction, objectives and expectations | • Personal introductions/know your audience  
  • Presentations  
  • Plenary discussions | • Flip charts  
  • PowerPoint presentations | 30 minutes |
| 12.6.2 Climate smart tillage options          | • Presentations  
  • Plenary discussions | • Flip chart  
  • PowerPoint presentation  
  • Participants’ handouts | 30 minutes |
| 12.6.3 Tractor mounted planter described and explained | • Presentations  
  • Plenary discussions | • Flip chart  
  • PowerPoint presentation  
  • Participants’ handouts  
  • Practical | 30 minutes |
| 12.6.4 Pest control equipment and tools usage | • Presentations  
  • Plenary discussions | • Flip chart  
  • PowerPoint presentation  
  • Participants’ handouts  
  • Practical | 30 minutes |
| 12.6.5 Harvesting equipment demonstrated      | • Presentations  
  • Plenary discussions | • Flip chart  
  • PowerPoint presentation  
  • Participants’ handouts  
  • Practical | 1 hour |
| 12.6.6 Grading equipment demonstrated         | • Presentations  
  • Plenary discussions  
  • Demonstrations | • Flip chart  
  • PowerPoint presentation  
  • Participants’ handouts  
  • Practical | 30 minutes |
| 12.6.7 Module review                          | • Presentations                        | • PowerPoint presentation                  | 30 minutes |

**Total** 4 hours
# 12.7 Facilitator’s Guidelines

## Module 12: Mechanization of potato production activities

### 12.7.1 Introduction, Objectives and Expectations (30 minutes)

(The facilitator welcomes trainees to the module on potato harvesting and post-harvest management that help reduce the post-harvest losses. They are then invited to introduce themselves and state their expectations).

### Module Objectives (30 minutes)

The facilitator presents modules objectives.

By the end of the module the trainee should be able to:

- Identify and explain various climate smart tillage operations.
- Describe and explain tractor mounted potato planter operations.
- Demonstrate pest control equipment and tools, usage.
- Demonstrate potato harvesting equipment.
- Demonstrate grading machines and equipment.

*In each case stating approximate prices and availability of machines

### 12.7.2. Potato climate smart land preparation tools (30 minutes)

(The facilitator presents on the commonly known Potato pests that are of economic importance).

#### Plenary presentation (20 minutes)

PowerPoint presentation highlighting:

- Overview of the potato mechanization activities.
- Climate smart tillage options.

#### Discussion (10 minutes)

Let the trainees recall what they learned and discuss any issue that may arise.

### 12.7.3. Potato calibration of fertilizer and seed rate for planters (30 minutes)

#### Plenary Presentation (20 minutes)

PowerPoint presentation highlighting on:

- Description and explanation of tractor mounted potato planting operations

#### Discussion (10 Minutes)

Let the trainees recall what they learned and discuss any issue that may arise.
### 12.7.4. Potato Chemical implements and tools operations (30 minutes)

**Plenary Presentation (20 minutes)**
PowerPoint presentation highlighting on:
- Techniques and methods of using potato pest control equipment.

**Discussion (10 Minutes)**
Let the trainees recall what they learned and discuss any issues that may arise.

### 12.7.5. Potato harvesting machine operating principles (1 hour)

**Plenary Presentation (30 minutes)**
PowerPoint presentation highlighting on:
- Techniques and methods of using potato harvesting equipment.

**Discussion (30 Minutes)**
Let the trainees recall what they learned and discuss any issues that may arise.

### 12.7.6 Machine and procedure for Potato grading (30 minutes)

**Plenary Presentation (15 minutes)**
PowerPoint presentation highlighting:
- Techniques and methods of using potato grading equipment.

**Practical exercise (15 minutes)**
Demonstrations on management options

### 12.7.7 Module review (30 minutes)

*(The facilitator leads the trainees in reviewing the module). Summarize the main points of the training and together with the participants review the main points:*
- Demonstrate various climate smart tillage operations.
- Various tractor mounted planting operations.
- Chemical implements and tools operations.
- Harvester equipment operations.
- Grading equipment operations.

*(Discuss with trainees about new things learned from this Module. What are some of the problems and issues that they have become more aware of in the module?)*

### 12.8. Participants’ Handouts
- KCEP Potato Manual
- Pamphlets, leaflets.
13.1 Introduction to the module
This module is designed for use in training facilitators of FFBS on potato farming business and marketing. This is necessary to improve their knowledge, skills and attitude on farming as business enterprise, market assessment and developing business and marketing plans. It should enable the facilitator to guide farmers on producing potatoes for a target market that has been identified.

Farmers rarely understand how the market operates and thus produce with uncertainty. There is a disconnect between production and marketing whereby most farmers believe their role ends when the produce matures. Selling of potatoes is done at farm gate. In most cases, potato farmers engage middlemen who provide labor for harvesting and linking the produce to the market. These middlemen facilitate value addition through engaging in upstream value chains activities like sorting, grading, packaging, storage and aggregation that should otherwise have been undertaken by the farmer or farmer groups. In the process, the middlemen earn income from performing those functions instead of the farmers.

Potato farming in Kenya is majorly practiced as a subsistence undertaking by small holder farmers producing potatoes without clear marketing strategies. Rarely is enterprise analysis and planning done before planting under climate change realities. This often leads to low sale prices for produce and hence reduced income thereby leaving the farmer with little for re-investing in the farm.

13.2 Module Learning Outcomes
This module aims at empowering farmers to increase productivity and improve market assessment for enhanced incomes, developing entrepreneurial attitudes and promoting commercial potato farming. By the end of the training the trainees should be able to:

1. Have good understanding of farming as a business concept.
2. Guide potato farmers or their groups in developing a potato enterprise business plan.
3. Identify market assessment methods and tools.
4. Conduct a potato market assessment survey.

13.3 Module Target Groups
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 facilitators using this module should thoroughly familiarize themselves with the participants’ handouts.

13.5 Module duration
The module is estimated to take 8 hours 40 minutes
## 13.6 Module Summary

### Module 13: Potato farming business and marketing

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Training methods</th>
<th>Training materials</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.6.1 Introduction, objectives and expectations</td>
<td>▪ Personal introductions ▪ Presentation</td>
<td>▪ Flips charts ▪ Felt pens, masking tape or sticker glue, notebooks and pens ▪ PowerPoint presentation</td>
<td>10 minutes</td>
</tr>
<tr>
<td>13.6.2 Introduction to Potato farm business management and concept of commercial potato farming</td>
<td>▪ Plenary Presentations and discussions ▪ Group exercise ▪ Summary presentation</td>
<td>▪ Flips charts ▪ Felt pens ▪ PowerPoint presentations</td>
<td>10 minutes 20 minutes</td>
</tr>
<tr>
<td>13.6.3 Key requirements for potato enterprise management and analysis of potato enterprise management under climate risk</td>
<td>▪ Plenary Presentations and discussions ▪ Group exercise</td>
<td>▪ Flips charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants handouts</td>
<td>20 minutes 40 minutes</td>
</tr>
<tr>
<td>13.6.4 Potato Business planning and financing</td>
<td>▪ Plenary Presentations and discussions</td>
<td>▪ PowerPoint presentations ▪ Flips charts ▪ Felt pens</td>
<td>5 minutes 30 minutes</td>
</tr>
<tr>
<td>13.6.5 Potato enterprise options under climate risk</td>
<td>▪ Plenary Presentations ▪ Brainstorming Group exercise</td>
<td>▪ Flips charts ▪ PowerPoint presentations ▪ Felt pens</td>
<td>10 minutes 30 minutes</td>
</tr>
<tr>
<td>13.6.6 Introduction to marketing and market assessment</td>
<td>▪ Plenary Presentations and discussions ▪ Group exercise ▪ Summary presentation</td>
<td>▪ Flips charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants handouts</td>
<td>30 minutes</td>
</tr>
<tr>
<td>13.6.7 Market assessment and marketing plans</td>
<td>▪ Plenary Presentations and discussions on market assessment ▪ Group exercise</td>
<td>▪ Flips charts ▪ Felt pens ▪ PowerPoint presentations ▪ Participants’ handouts</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>
### Market Assessment Plan
- Develop market tools
- Market excursion
- Market results
- Marketing plan
- Marketing strategies
- Additional strategies

<table>
<thead>
<tr>
<th>Duration</th>
<th>Tools</th>
<th>Session Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 minutes</td>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>PowerPoint presentations, Flips charts, Felt pens, Plenary Presentations and discussions, Group exercise</td>
</tr>
<tr>
<td>1 hour 30 minutes</td>
<td></td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
<tr>
<td>20 minutes</td>
<td>Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
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</table>

### Market Excursion

<table>
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<th>Tools</th>
<th>Session Guide</th>
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<tbody>
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<td>10 minutes</td>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
<tr>
<td>20 minutes</td>
<td>Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
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</tbody>
</table>

### Market Results

<table>
<thead>
<tr>
<th>Duration</th>
<th>Tools</th>
<th>Session Guide</th>
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<tbody>
<tr>
<td>15 minutes</td>
<td></td>
<td>Plenary Presentations and discussions, Group exercise</td>
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<tr>
<td>20 minutes</td>
<td></td>
<td>Plenary Presentations and discussions, Group exercise</td>
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</table>

### Marketing Plan

<table>
<thead>
<tr>
<th>Duration</th>
<th>Tools</th>
<th>Session Guide</th>
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<tbody>
<tr>
<td>10 minutes</td>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
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<tr>
<td>20 minutes</td>
<td>Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
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</table>

### Marketing Strategies

<table>
<thead>
<tr>
<th>Tools</th>
<th>Session Guide</th>
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</thead>
<tbody>
<tr>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
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</tbody>
</table>

### Additional Strategies

<table>
<thead>
<tr>
<th>Tools</th>
<th>Session Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
</tbody>
</table>

### Powerpoint Presentations

<table>
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<th>Duration</th>
<th>Tools</th>
<th>Session Guide</th>
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<tr>
<td>10 minutes</td>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
<tr>
<td>20 minutes</td>
<td>Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
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</table>

### Flips Charts

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<th>Tools</th>
<th>Session Guide</th>
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<tr>
<td>10 minutes</td>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
<tr>
<td>20 minutes</td>
<td>Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
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</table>

### Felt Pens

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<tr>
<th>Duration</th>
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<tr>
<td>10 minutes</td>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
<tr>
<td>20 minutes</td>
<td>Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
</tbody>
</table>

### 13.6.8 Introduction to potato business planning

<table>
<thead>
<tr>
<th>Duration</th>
<th>Tools</th>
<th>Session Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 minutes</td>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
<tr>
<td>20 minutes</td>
<td>Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
</tbody>
</table>

### 13.6.9 Potato business planning under climate risk

<table>
<thead>
<tr>
<th>Duration</th>
<th>Tools</th>
<th>Session Guide</th>
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<tbody>
<tr>
<td>20 minutes</td>
<td>PowerPoint presentations, Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
</tr>
<tr>
<td>20 minutes</td>
<td>Flips charts, Felt pens</td>
<td>Plenary Presentations and discussions, Group exercise</td>
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### 13.6.10 Module review

<table>
<thead>
<tr>
<th>Duration</th>
<th>Tools</th>
<th>Session Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 minutes</td>
<td>Flips charts, PowerPoint Presentation, Participants’ handouts, Module review</td>
<td>Facilitators Summary, Participants’ questions</td>
</tr>
</tbody>
</table>

### TOTAL

7 hours 40 minutes

### 13.7 Facilitator’s Guidelines

#### 13.7.1 Introduction to the Module and leveling expectations (10 minutes)

**Introduction**

(The facilitator welcomes participants to the module, invites them to state their expectations).

**Module Objectives**

(The facilitator presents module objectives)

By the end of the module participants should be able to:

- Facilitate farmers to adopt the concept of potato farming business.
- Develop and guide farmers in potato enterprise development and marketing.
- Facilitate farmers in developing potato enterprise business and marketing plan.

**Session Guide**

- Summarize Participants’ “expectations” and display.
- PowerPoint presentation

**Duration**

10 minutes
**13.7.2- Introduction to Potato Farm Business Management and Concept of Commercial Production (30 minutes)**

(The facilitator defines the term **business** and **market assessment**).

**Business**

Many people think that potato farming and any other form of farming is not business. The first point to make is that this is not so; most of smallholder farmers in Kenya practice farming as a subsistence activity, whereby sales are made without seriously considering profit. They sell to raise cash for other uses at farm.

Ask these questions to initiate discussion about the session.

- What is a business?
- What business are we familiar with?

A business is an activity operated by an entrepreneur for the purpose of:

- Earning a profit by providing a service or a product to the buyer.
- Putting money into risk expecting a return to investment.
- Risk taking under uncertainty- climate risks.

**Characteristics of a Good Business Venture**

(Lead the participants find meaning to the characteristics)

- Something you are passionate about.
- Has a specific market niche?
- With low start-up capital- let the business grow.
- Has low initial fixed costs.
- Scalability-has opportunity to grow or scale out.

**Session Guide**

- List the answers on flip charts
- PowerPoint presentation

<table>
<thead>
<tr>
<th>Duration</th>
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<tbody>
<tr>
<td>10 minutes</td>
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<tr>
<td>20 minutes</td>
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</tbody>
</table>

**13.7.3 Key requirements for potato enterprise management and analysis of potato enterprise management under climate risk (1 hour)**

(The facilitator conducts an exercise on input and operational requirements for potato production).

Farmers are either subsistence or commercial farmers oriented. Subsistence farmers grow potato for home use and only sell surplus. Conversely, commercial farmers produce for sale and consume what is surplus.

**Session Guide**

- PowerPoint presentation
- Flip charts

<table>
<thead>
<tr>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>20 minutes</td>
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</tbody>
</table>
Group exercise:
What are the inputs involved in potato production?
  • Seeds, fertilizers, agrochemicals,
  • Land
  • Labour
  • Capital
  • Machinery
What are the operational activities involved?
  • Land preparation
  • Sowing
  • Agronomic practices
  • Harvesting and storage.
What are the marketing activities involved?
  • Packaging
  • Aggregating
  • Transport to market
  • Sales

Principles of Business Management
(Referring to handouts on definition and comparison of businesses, discuss the principles of management)
Principles of business management are also known as principles of management: In plenary let participant mention what these principles stand for.
  • Forecasting and planning.
  • Organizing.
  • Commanding.
  • Coordinating.
  • Controlling.

Analysis of Potato Enterprise
(The facilitator should guide a discussion on gross margin analysis and net income calculations)

Presentation and Discussion
For a farmer to engage in potato farming it is important to understand how the enterprise performs. What the farmer needs to know in order to decide on potato production. For the farmer to understand whether to sell at the farm level or to include marketing. A gross margin analysis will help us to understand the business well.

Present the Gross Margin Analysis?
Gross margin is sometimes referred to as cost-benefit ratios.
Gross margin is the same as the difference between total sales of output and the total costs of producing that item.

Gross Margin = Total Sales – Total Costs of Production

To calculate gross margin, one needs to have the following data:

i. Total sales value – produce volume and selling price.
ii. Total production costs – inputs costs, operational costs.

**What are the benefits of Gross Margin analysis?**
The key benefits are that it allows one to:

- Understand return from ‘enterprise’.
- Make decisions on inputs and costs in relation to expected returns.
- Decide on management of inputs and operations for optimal production and return.

**What is Net Income?**
If a farmer is also engaged in marketing the produce and therefore does not sell on the farm or at the farm gate, s/he incurs marketing costs. As such, his/her net income is equal to the gross margin less that marketing cost.

Net income = Gross margin – Marketing cost

**Group exercise** – in your groups carry out gross margin and net income analysis for your county. One group presents and the others chips in.

**Some strategies of enhancing returns from the potato farming business**
Ask participants to mention cost saving and income enhancing strategy for a potato farm. Then present in plenary.

**Cost saving strategies**
- Pooling resources through a co-operative or a group
- Re-investing returns from previous profits
- Following proper good agronomic practices

**Income enhancement strategies**
- Timely harvesting to take advantage of the market.
- Using the right varieties of potatoes required by the market
- Good agronomic practices to enhance productivity.
- Value addition.

*Summary by facilitating a discussion on “What other strategies can a farmer engage in to enhance return from potato.”*

<table>
<thead>
<tr>
<th>13.7.4 Potato Business Planning and Financing (30 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Plan Definition (5 Minutes)</strong></td>
<td>Distribute the Participants’ Handouts: Business planning</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Initiate discussion by asking what a business plan is, then present in the plenary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A business plan is a written document that describes in detail how a business, (usually a new one) is going to achieve its goals. It lays out a written plan from a marketing, financial and operational viewpoint up to marketing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>The Benefits of a Business Plan?</strong></td>
<td></td>
<td>15 minutes</td>
</tr>
<tr>
<td>- Guides the investor in operation.</td>
<td></td>
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<tr>
<td>- Required documents especially when looking for external financing.</td>
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<tr>
<td>- It is a path to successful future.</td>
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<tr>
<td>- An opportunity to test new ideas.</td>
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</tr>
<tr>
<td>- A clear statement of business mission and vision.</td>
<td></td>
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<tr>
<td>- A set of values that can help to steer business through turbulence.</td>
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<td></td>
</tr>
<tr>
<td><strong>What is Business Financing?</strong></td>
<td></td>
<td>10 minutes</td>
</tr>
<tr>
<td>Business financing is the act of providing funds for enterprise for, making purchases or investing in equipment for operations. Business finance is a term that encompasses a wide range of activities and disciplines revolving around the management of money and other valuable assets.</td>
<td></td>
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</tr>
<tr>
<td><strong>Types of Finances available to The Potato farmers in the area</strong></td>
<td></td>
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</tr>
<tr>
<td>- Short term- used to meet the day-to-day operation expenses.</td>
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<tr>
<td>- Medium term - used to modernize machinery and to improve other facilities.</td>
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<tr>
<td>- Long term - used to buy fixed assets.</td>
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<tr>
<td><strong>Sources of finances for potato farming business</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sources of finances would depend on the duration for which it is required– Short Term, Medium or Long Term</td>
<td></td>
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<tr>
<td>External: bank loan, grants, credit supply, owners’ investments, loans from family and friends, among others</td>
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<tr>
<td>Internal sources: profits ploughed back, sale of business assets and others (participants to be asked for more examples)</td>
<td></td>
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</tr>
</tbody>
</table>
### 13.7.5 Potato enterprise options under climate risk (1 hour)

(The facilitator should guide discussion on risk management).

For a farmer to engage in potato farming it is important to understand the risks associated with potato production under climate risk.

List the climate mitigating technologies and TIMPS under potato:
- Varieties.
- Appropriate Good Agricultural Practices.
- Seed potato production technologies.
- Pest and diseases management.
- Postharvest management.

**Group exercise:** Participants analyze the climate risk in their respective counties, suggest remedies and carry out a Gross Margin analysis when the climate risk remedy is used.

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>PowerPoint presentation</td>
<td>10 minutes</td>
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<td>20 minutes</td>
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<td>30 minutes</td>
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</tbody>
</table>

### 13.7.6. Introduction to marketing and market assessment (35 minutes)

**Introduction to marketing and market assessment**

**Introduction**

(The facilitator should be able to introduce market assessment issues. Define market assessment and what it entails as well as its benefits)

Once participants understand that farming is a business then the need to understand how the market works becomes critical and this is market assessment.

**Module Objectives**

By the end of the module participants should be able to:
- Facilitate farmers to adopt the concept of potato marketing.
- Identifying market assessment methods and tools.

**Definition**

Market: The sum total of all the buyers and sellers. Wherever exchange of money and potatoes occurs is the market so its not a place but a function.

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants’ handouts</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Costs of marketing potatoes</td>
<td></td>
</tr>
<tr>
<td>PowerPoint presentation</td>
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</tbody>
</table>
Market assessment: Refers to qualitative and quantitative analysis of the market to help farmers gauge the attractiveness of the market as well as the requirements of the market. It is a snap-shot of the market to help farmers in planning their production.

**What are the costs for marketing potatoes?**
Marketing costs: processing, branding, advertisement, selling, transport.

What are the marketing activities in each of these?
- Transportation of the products to the market
- Processing, packaging, labeling
- Storage
- Insurance

Ask one of the groups to present as others chip in and discuss. Summarize the key points.

<table>
<thead>
<tr>
<th>13.7.7 Market assessment and develop marketing plan (3h 25 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>PowerPoint Presentation</td>
<td>15 minutes</td>
</tr>
<tr>
<td><em>(The facilitator should be able to explain the steps to follow when conducting a market assessment).</em></td>
<td>Flip Charts Group presentations</td>
<td>40 minutes</td>
</tr>
<tr>
<td><strong>Module Objectives</strong></td>
<td></td>
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</tr>
<tr>
<td>By the end of the module trainees should be able to:</td>
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<tr>
<td>- Conduct a potato market assessment.</td>
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<tr>
<td>- Facilitate potato farmers to develop potato marketing plans.</td>
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<tr>
<td><strong>Market Assessment Plan</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overview of market assessment, its importance and what it entails</td>
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</tr>
<tr>
<td>- Lead group discussion on the information required in order to know the requirements of a market and list them.</td>
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<tr>
<td>- Presentation on the types of data required.</td>
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<tr>
<td><strong>Market assessment tools and procedures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overview of various types of market assessment tools, their advantages and how to use each type</td>
<td></td>
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</tr>
<tr>
<td><strong>Group exercise:</strong> Develop a market assessment tool for the different markets (questionnaires or checklists for the different market actors (wholesaler, distributor, retailer, institution) to be used.</td>
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</tr>
</tbody>
</table>
**Practical market assessment**

*Preparation: Objective of the market visit.*

*Market visit: Go to the market.*

*Group exercise: Each group to present market data collected*

### Analysis of market data collected.
Market segment, price trends over the year, supply and demand trends over the year, market requirements (variety, tuber size, quality, packaging).

**Developing a marketing plan**

- Target market, customer profile, competitor profile

Marketing plan should include; Summary of marketing plan, background analysis of potato business and market, marketing objectives and strategy for the potato business, marketing mix, action plan and budget, evaluation and monitoring strategies

- Use potato product (crisps) and develop marketing plan for it as an example

**Additional marketing strategies**
Ask participants to name marketing strategies for a potato farm. Then present in plenary

- Market linkages.
- Digital platforms (including Viazi Soko platform).
- Contract farming.
- Compliance with potato policies and regulation.

### 13.7.8 Potato Business Planning (1 hour)

<table>
<thead>
<tr>
<th>Session Guide</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>Powerpoint presentation, Flip Charts</td>
<td>1 hour 30 minutes</td>
</tr>
<tr>
<td>PowerPoint Presentation</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Market excursion</td>
<td>20 minutes</td>
</tr>
<tr>
<td>, Flip charts Group exercise</td>
<td></td>
</tr>
<tr>
<td>PowerPoint presentation</td>
<td>10 minutes</td>
</tr>
<tr>
<td></td>
<td>15 minutes</td>
</tr>
<tr>
<td>Distribute the Participants’ handouts</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Business planning; legal requirements for SME’s</td>
<td></td>
</tr>
<tr>
<td>PowerPoint presentation, Flip charts Group presentations</td>
<td></td>
</tr>
</tbody>
</table>
• A clear statement of business mission and vision.
• A set of values that can help to steer business through turbulence.

**Parts of a business plan**

Although the specifics may vary, here are the typical components of a business plan. The cover page should include;

• Name of the business, business logo, contact information, Contact person, Address, Year/Date.
• The executive summary-is a nutshell summary of the entire plan.
• Business description-describes the proposed new endeavors, explains its purpose and the target market.

*The organizational and managerial section - explains the envisioned structure of the business. What positions and departments it will encompass:
• Product (services) section-shows the details of that you are offering.
• Financial section- shows how the business will be financed? Is financing sought from internal or external sources.

Every business requires financing for inputs and operations.

*Group Exercise:*

Develop a business plan for a potato business

<table>
<thead>
<tr>
<th>13.7.9 Potato business planning under climate risk (40 minutes)</th>
<th>Session Guide</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Risk</td>
<td>PowerPoint Presentation, Flip charts Group presentations</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Defining risky areas.</td>
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<tr>
<td>Determining indicators for the risk.</td>
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<tr>
<td>Determine how to measure the risk for your business.</td>
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<tr>
<td>Monitoring all risks.</td>
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<tr>
<td>Concrete activities to deal with the risk.</td>
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<tr>
<td>Monitoring of implemented activities.</td>
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<tr>
<td>Revision.</td>
<td></td>
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<tr>
<td>Group Exercise:</td>
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<tr>
<td>Discuss how to plan a business while taking risk (including climate risk) into consideration</td>
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</tbody>
</table>
13.7.10 Module Review (15 minutes)

(The facilitator should be able to help the participant to review the module training by looking at what the message is and its application to potato farming business and market assessment)

Let us review together the main points about potato farming business and market assessment.

- 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 potato farming as a business module?
- What questions do you still have about Potato farming business and market assessment?

This last Participants’ handout summarizes the main points from the Module.

- Who can explain what has been learned? The first point or message and its application? The second message? The third message?

Thank you for joining us in this module, and we hope to see you in other modules in the future.

13.8 References

14.1 Introduction to the Module
This module exposes the service providers, lead farmers and facilitators to Agricultural Innovation Platforms (AIPs). An AIPs is an organizational model for stimulating innovation and development and connecting stakeholders of a specific value chain in a way that pools together their skills and knowledge to address challenges and utilize opportunities within the value chain. These actors/stakeholders include individuals, traders, aggregators, private and public sector organizations, policy makers and other value chain stakeholders. In an AIP, 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.

Kenya adopted Vision 2030 in 2007 as a new blueprint and roadmap for political, social and economic development of the country in the next two decades. The Vision also 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 and county) with defined functions. Agriculture is one of the devolved governance functions although it is faces many challenges and threats such as climate change, declining agricultural performance, limited high potential agricultural land, high rate of land degradation, and over-reliance on rainfed agriculture, limited diversification of agricultural production, poor and inadequate rural infrastructure, inadequate and declining research in agriculture, 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, facilitators and relevant stakeholders to the design and implementation of effective climate-smart-sensitive agricultural policy options to promote the transition to climate-smart agriculture at the smallholder level.

Potato has proven to be a potential agro-enterprise for all gender categories (men, women, youth and vulnerable marginalized groups (VMGs)) that have adopted various technologies, innovations and management practices (TIMPs) from production, marketing and consumption along the value chain. However, gender inequalities exist in all areas of the value chain such as division of labour, access to and control of resources and decision making within and beyond the households. This hinders effective participation of women, youth and VMGs due to their low decision-making power, lack of voice and lack of access to financial resources that also limits their access to benefits from the different nodes of the value chain. 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. Potato value chain TIMPs interventions, when designed and implemented with gender equitable principles, will foster adoption leading to increased productivity as well as enhanced social and environmental impacts.

Climate change impacts differently on the various gender classes and even increases their vulnerability especially during hazards. Gender mainstreaming in climate smart agriculture (CSAs) provides a guidance for practitioners to recognize where and how gender considerations should be taken into account as part of the process of planning, designing, and promoting climate smart technologies and practices along the potato value chain to ensure inclusivity. Gender mainstreaming includes systematically integrating gender into every step of the process of climate change adaptation and mitigation from problem statement to potential solutions; the methodology and approach for implementing solutions including policy making (The Pacific Gender and climate change tool Kit, 2007). Therefore this module aims to ensure that gender mainstreaming and social inclusion in potato TIMPs is enhanced by field agricultural practitioners and extension officers as an effort geared towards achieving Climate Smart Agriculture “triple win” in target counties.

### 14.2 Module learning outcomes.

1. By the end of the module, the following will be achieved:
2. Definition of an agricultural innovation platform (AIP).
3. The attributes of an AIP appreciated and applied.
4. Stakeholders mobilized to establish an AIP.

The trainee should also be able to explain the following in policy:
- The role of agricultural policy frameworks in Kenya.
- Climate-smart agriculture practices, policy options and approaches
- Implementation of the climate-smart-sensitive policy at the county level.
- Financing and investments for Climate-smart Agriculture.
- The need for a technology policy.

The trainee should be able to assist farmers in acquiring the following in gender and socio issues in potato production:
- Concept of gender mainstreaming and social inclusion in potato value chain understood and enhanced.
- Youth empowerment in potato value chain improved.
- Women empowerment in potato value chain up-scaled.
- Strategies for inclusion of vulnerable and marginalized groups in potato value chain promoted.
- Socio-cultural barriers in potato value chain identified and addressed.
- Environmental and social management framework (ESMF) tool understood.

### 14.3 Module Target Group

This module is intended for service providers, policy makers, public extension agents and relevant stakeholders along the potato value chain.
14.4 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 facilitators using this module should adequately familiarize themselves with the participants’ handouts.

14.5 Module Duration
The module is estimated to take 16 hours 35 minutes.

14.6 Module Summary

<table>
<thead>
<tr>
<th>Module 14. Cross cutting issues (innovation platforms, policy, gender mainstreaming and social inclusion)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agricultural Innovation Platforms</strong></td>
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<tr>
<td><strong>Sessions</strong></td>
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</tr>
<tr>
<td>14.6.1. Introduction and levelling expectations</td>
</tr>
<tr>
<td>14.6.2 An overview of an Agricultural Innovation Platform (The characteristics of an innovation platform)</td>
</tr>
<tr>
<td>14.6.3. Stakeholder analysis</td>
</tr>
<tr>
<td>14.6.4. Pre-formation stages –stakeholder mobilization and sensitization. -AIP Phases (initiation, establishment, management and sustenance)</td>
</tr>
<tr>
<td>14.6.5. Module review</td>
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<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>Policy</td>
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<td>-----------------</td>
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<tr>
<td><strong>14.6.6. Introduction, learning expectations and outcomes</strong></td>
</tr>
<tr>
<td>Personal introductions</td>
</tr>
<tr>
<td>Group discussions</td>
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<tr>
<td>Plenary discussions</td>
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<tr>
<td>Presentations</td>
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<td>Flips charts</td>
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<tr>
<td>PowerPoint presentations</td>
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<td>1 hour</td>
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<tr>
<td><strong>14.6.7. Agricultural policy frameworks in Kenya</strong></td>
</tr>
<tr>
<td>Presentations</td>
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<tr>
<td>Practical exercises</td>
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<tr>
<td>Plenary discussions</td>
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<td>PowerPoint presentations</td>
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<td>30 minutes</td>
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<tr>
<td><strong>14.6.8. Climate-smart agriculture practices, policy options and approaches</strong></td>
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<tr>
<td>Presentations</td>
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<td>Practical exercises</td>
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<td>Plenary discussions</td>
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<tr>
<td>PowerPoint presentations</td>
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<td>1 hour</td>
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<tr>
<td><strong>14.6.9. Climate-smart-sensitive policy cycle and at the county level</strong></td>
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<tr>
<td>Presentations</td>
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<td>Plenary discussions</td>
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<tr>
<td>Practical exercise</td>
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<td>Plenary discussions</td>
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<tr>
<td>PowerPoint presentations</td>
</tr>
<tr>
<td>Participant’s handouts</td>
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<tr>
<td>1 hour 30 minutes</td>
</tr>
<tr>
<td><strong>14.6.10. Financing and Investments for Climate-smart Agriculture</strong></td>
</tr>
<tr>
<td>Presentations</td>
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<tr>
<td>Practical exercise</td>
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<tr>
<td>Plenary discussions</td>
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<td>Flips charts</td>
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<td>PowerPoint presentations</td>
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<tr>
<td>Participant’s handouts</td>
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<tr>
<td><strong>14.6.11. Technology Policy</strong></td>
</tr>
<tr>
<td>Presentations</td>
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<tr>
<td>Plenary discussions</td>
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<tr>
<td>Flips charts</td>
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<td>PowerPoint presentations</td>
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<tr>
<td>Participant’s handouts</td>
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<tr>
<td>30 minutes</td>
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<tr>
<td><strong>14.6.12. Module Review</strong></td>
</tr>
<tr>
<td>Plenary discussion</td>
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<td>Flips charts</td>
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<td>Felt pens</td>
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<tr>
<td>30 minutes</td>
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<td><strong>Total</strong></td>
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<td>6 hours</td>
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<tr>
<td>Sessions</td>
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<tr>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>14.6.13. Introduction, expectations and objectives</td>
</tr>
<tr>
<td>14.6.14 How climate change affects different gender groups</td>
</tr>
<tr>
<td>14.6.15. Gender mainstreaming in climate smart potato value chain</td>
</tr>
<tr>
<td>14.6.16. Youth and women empowerment in potato value chain</td>
</tr>
<tr>
<td>14.6.17. Strategies for inclusion of vulnerable and marginalized groups</td>
</tr>
<tr>
<td>14.6.18. Environmental and social management framework (ESMF). Socio economic and environmental impact of potato activities.</td>
</tr>
<tr>
<td>14.6.19. Module Review</td>
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<tr>
<td><strong>Total</strong></td>
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</tbody>
</table>
### 14.7 Facilitator’s Guidelines

<table>
<thead>
<tr>
<th>14.7.1. Introduction and levelling of expectations (10 minutes)</th>
<th>Session Guide</th>
</tr>
</thead>
</table>
| **Introduction (10 minutes)**  
*The facilitator welcomes participants to the module on Agricultural Innovation Platforms. They are then invited to introduce themselves and state their expectations* |  
- Summarize participants’ “expectations” and display.  
- PowerPoint presentation  
- Module objectives |
| **Module objectives**  
*(The facilitator presents modules objectives and levels out expectations)* |  |
| By the end of the module participants should be able to:  
- Explain characteristics of an innovation platform.  
- Mobilize and sensitize stakeholders.  
- Describe how to initiate and establish agricultural innovation Platforms.  
- Explain how to manage and sustain innovation capacity of actors in agricultural innovation platforms. |  |

### 14.7.2. The characteristics of an innovation platform (40 minutes)

*The facilitator should present an overview of innovation platforms and their main characteristics.*

<table>
<thead>
<tr>
<th>Plenary Presentation (30 minutes)</th>
<th></th>
</tr>
</thead>
</table>
| - Past progression of research and extension models and their shortcomings.  
- Agricultural innovation systems perspective.  
- Agricultural innovation platforms model.  
- Comparison of agricultural innovation platforms with social and technical events working through committees with different roles but common goals.  
- Value chain actor linkages and other benefits. |  
- PowerPoint Presentation  
- Participants’ Handouts,  
- PowerPoint presentations |

### 14.7.3 Stakeholder analysis (45 minutes)

*The facilitator should introduce the topic of stakeholder analysis*

<table>
<thead>
<tr>
<th>Stakeholder analysis (45 minutes)</th>
<th>Session Guide</th>
</tr>
</thead>
</table>
| **Definition of stakeholder analysis**  
Group discussions – Types of stakeholders  
- Facilitator explains the importance of stakeholder analysis.  
- Facilitator takes the participants through different modes of stakeholder analysis. |  
- PowerPoint presentation  
- Participants’ handouts,  
- PowerPoint presentations |
### 14.7.4. Pre-formation and formation phases of the Potato AIP (2 hours 30 minutes)

**Plenary Presentation (1 hour)**
Facilitator presents on:

<table>
<thead>
<tr>
<th><strong>Initiation or pre-formation phase</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Engagement or mobilization of stakeholders in the potato value chain.</td>
</tr>
<tr>
<td>• Visioning process and rules of engagement mediated by an initiator such as change agent.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Establishment</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Assessment of the status of the value chain to clearly identify the compelling agenda or bottleneck - APVC analysis to identify weaknesses in the chains.</td>
</tr>
<tr>
<td>• Laying out of proper plans to define roles, establish task-based committees, expected milestones and resourcing strategies.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Management</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Keeping stakeholders focused on the vision and upholding values to ensure an inclusive and transparent process.</td>
</tr>
<tr>
<td>• Neutral facilitation to ensure joint strategy building and action and the coordination of support activities.</td>
</tr>
<tr>
<td>• Managing emerging experts taking up leading roles and issues as champions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Sustainability</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Guiding in evolving and identifying fresh issues or challenges.</td>
</tr>
<tr>
<td>• Maintaining capacity acquired to address new issues or challenges in subsequent cycles.</td>
</tr>
</tbody>
</table>

**Group discussions – 35 minutes**

Facilitator asks the participants to discuss the challenges they anticipate in the establishment, management and sustainability of AIPs at county levels?

**Discussion (55 minutes)**

Group presents their findings and take-home lessons

<table>
<thead>
<tr>
<th><strong>Session Guide</strong></th>
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</thead>
<tbody>
<tr>
<td>• PowerPoint presentation</td>
</tr>
<tr>
<td>• Distribute participants handouts</td>
</tr>
<tr>
<td>• Short video clips</td>
</tr>
</tbody>
</table>
### 14.7.5. Module review (30 minutes)

*(The facilitator leads the participants in reviewing the module)*

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

- AIP characteristics and initiation.
- AIP establishment and management.
- Sustenance of potato AIPs.

*(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?)*

### 14.7.6 Climate-Smart Agricultural Policy

**Introduction, Expectations and Outcomes (20 minutes)**

*(The facilitator welcomes participants to the module on Climate-Smart Agricultural Policy module)*

**Participant’s (trainees) expectations (10 minutes)**

*(The facilitator to list their expectations)*

**Module Outcomes (10 minutes)**

*(The facilitator presents module learning Outcomes)*

By the end of this module, participants are expected to:

- 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.

### 14.7.6.1 Agricultural Policy Frameworks in Kenya (1 hour)

**Plenary presentation (20 minutes)**

**Presentation highlighting:**

- List all policies that affect agriculture in Kenya.
- The role of agricultural policy frameworks in Kenya.

**Group work- Practical Exercise (30 minutes)**

*(The facilitator requests participants to identify the gaps between agricultural policy frameworks and the existing agricultural policies)*

- PowerPoint presentation
- Distribute participants handouts
- Group exercise
<table>
<thead>
<tr>
<th>Session Guide</th>
<th>14.7.6.2 Climate-smart agriculture practices, policy options and approaches (1 hour)</th>
<th>Plenary presentation (20 minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Considerations for climate-smart production systems.</td>
<td>• PowerPoint presentation</td>
</tr>
<tr>
<td></td>
<td>• Existing systems, practices and methods suitable for climate-smart agriculture.</td>
<td>• Distribute participants handouts</td>
</tr>
<tr>
<td></td>
<td>• Institutional and policy options.</td>
<td>• Group exercise</td>
</tr>
<tr>
<td></td>
<td>• Ensuring farmer organizations for market access.</td>
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<tr>
<td></td>
<td>• Gendered approach.</td>
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<tr>
<td></td>
<td>Practical exercise and discussion(40 minutes)</td>
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<tr>
<td></td>
<td><em>(The facilitator requests the participants to form groups and identify the existing climate-smart agriculture practices and the relevant policy options for implementation)</em></td>
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<tr>
<td></td>
<td>14.7.6.3 Climate-smart-sensitive policy cycle and implementation at county level (1 hour 30 minutes)</td>
<td>Session Guide</td>
</tr>
<tr>
<td></td>
<td>Climate-smart-sensitive policy cycle <em>(20 minutes)</em></td>
<td>• PowerPoint presentation</td>
</tr>
<tr>
<td></td>
<td>Plenary Presentation</td>
<td>• Distribute participants handouts</td>
</tr>
<tr>
<td></td>
<td>• Stages in the climate-smart-sensitive policy cycle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Implementation of the climate-smart-sensitive policy at the county level <em>(40 minutes)</em></td>
<td></td>
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<tr>
<td></td>
<td>Plenary Presentation</td>
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<tr>
<td></td>
<td>• Phases in the implementation of the climate-smart-sensitive policy at the county level.</td>
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<tr>
<td></td>
<td>Group work -Practical exercise <em>(30 minutes)</em></td>
<td></td>
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<tr>
<td></td>
<td><em>(The facilitator requests the participants to form groups and develop a program showing steps, activities and stakeholders for the implementation of climate-smart policies)</em></td>
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<tr>
<td></td>
<td>Plenary Discussions <em>(30 minutes)</em></td>
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<tr>
<td></td>
<td>Groups present their discussions on programs of climate smart policies</td>
<td></td>
</tr>
<tr>
<td>14.7.6.4 Policy financing and investments for Climate-smart agriculture (1 hour)</td>
<td>Sessio Session Guide</td>
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<tr>
<td><strong>Plenary Presentation (20 minutes)</strong>&lt;br&gt;<em>Present the following on PowerPoint:</em>&lt;br&gt;• Why financing is needed.&lt;br&gt;• Financing gaps.&lt;br&gt;• Sources of financing.&lt;br&gt;• Financing mechanisms.&lt;br&gt;• Connecting action to financing.&lt;br&gt;• Types of subsidies to farmers.</td>
<td>• PowerPoint presentation&lt;br&gt;• Distribute participants handouts&lt;br&gt;• Practical Exercise</td>
<td></td>
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</tbody>
</table>

**Practical exercises and Plenary Discussions (40 minutes)**<br>(The facilitator requests the participants to form groups and identify potential sources of financing, financing mechanisms and connecting action to financing)

<table>
<thead>
<tr>
<th>14.7.6.5 Need of Technology Policy (30 minutes)</th>
<th>Session guide</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plenary Presentation (30 minutes)</strong>&lt;br&gt;• What is a technology policy?&lt;br&gt;• Why do we need technology policy?&lt;br&gt;• Is technology policy inconsistent with a market-oriented economy?&lt;br&gt;• Technology policy in Kenya.</td>
<td>• PowerPoint presentation&lt;br&gt;• Distribute participants handouts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>14.7.6.6 Module review (30 minutes)</th>
<th>Session guide</th>
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<tbody>
<tr>
<td><em>(The facilitator leads the participants in reviewing the module)</em>&lt;br&gt;Summarize the main points of the training.&lt;br&gt;What are some of the problems and issues that they have become more aware of in the module?</td>
<td>• Q&amp;A session&lt;br&gt;• Recap the main points&lt;br&gt;• Test understanding&lt;br&gt;• Participatory evaluation of the session</td>
</tr>
</tbody>
</table>
### 14.7.7 Gender mainstreaming and social inclusion in potato value chain

#### 14.7.7.1 Introduction and expectations (10 minutes)

*The facilitator welcomes participants to the module on gender mainstreaming and social inclusion in potato value chain. They are then invited to introduce themselves and state their expectations.*

**Module Objectives (10 minutes)**

(The facilitator presents modules objectives)

By the end of the module training participants are expected to:-

- Understand gender mainstreaming and social inclusion, in potato value chain.
- Understand youth empowerment in potato value chain.
- Understand women empowerment in potato value chain.
- Understand strategies for inclusion of vulnerable and marginalized groups in potato value chain.
- Understand socio-cultural barriers in potato value chain.
- Understand the environmental and social management framework (ESMF) tool.

#### 14.7.7.2 Gender mainstreaming and social inclusion in potato value chain (1 hour)

*The facilitator should present and explain what is gender mainstreaming, who does what activity, who has access to what resources and why gender mainstreaming is important in potato value chain.*

**Plenary Presentation (30 minutes)**

PowerPoint presentation on the following:

- Definition of gender.
- What is gender mainstreaming and why it is important?
- Who does what? (gender division of roles in potato value chain)
- Who owns what? (access and control of resources & benefits)
- Who makes which decisions?
- Socio-cultural limitations related to potato value chain.
- Existing policies in support of gender mainstreaming.

**General discussion (30 minutes)**

Let the trainees recall what they learned and discuss any issue that may arise.

<table>
<thead>
<tr>
<th>Session Guide</th>
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</thead>
<tbody>
<tr>
<td>• Summarize trainees’ “expectations” and display.</td>
</tr>
<tr>
<td>• PowerPoint Presentation</td>
</tr>
<tr>
<td>• Flipcharts</td>
</tr>
<tr>
<td>• Group exercise</td>
</tr>
<tr>
<td>• Objectives and training program</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session Guide</th>
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</thead>
<tbody>
<tr>
<td>• PowerPoint presentation</td>
</tr>
<tr>
<td>• Group exercise</td>
</tr>
<tr>
<td>• Plenary discussions</td>
</tr>
<tr>
<td>• Distribute participants handouts</td>
</tr>
<tr>
<td>• Group exercise</td>
</tr>
<tr>
<td>• Plenary discussions</td>
</tr>
</tbody>
</table>
### 14.7.7.3 Youth and women empowerment in potato value chains (1 hour 15 minutes)

**Youth empowerment plenary presentation (20 minutes)**

PowerPoint presentation highlighting:
- Why agriculture is not attractive to youth.
- Youth’s role in the value chain.
- Strategies to empower youth in potato value chain.

**Women empowerment plenary presentation (20 minutes)**

PowerPoint presentation highlighting:
- Women’s role in the value chain.
- Challenges facing women in the value chain.
- Strategies for empowering women in the value chain.

**Group discussion (20 minutes)**

Let the trainees recall what they learned and discuss any issue that may arise.

---

### 14.7.7.4 Strategies for inclusion of vulnerable and marginalized groups in potato value chain (1 hour)

**Plenary Presentation (30 minutes)**

PowerPoint presentation highlighting:
- Who are vulnerable and marginalized groups (VMGs)?
- Why gender inequality exists.
- Social inclusion and why?
- Strategies of inclusion of VMGs.

**Group exercise (30 minutes)**

- Strategies of inclusion of VMGs at county level

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### 14.7.7.5 Environmental and social management framework (ESMF) (1 hour)

**Plenary Presentation (40 minutes)**

PowerPoint presentation highlighting:
- Objective of ESMF in potato value chain.
- Impacts and action plans for safeguards.
- Environmental and socioeconomic impacts of potato value chain activities.

**Group discussion (20 minutes)**

Let the participants recall what they learned and discuss any issue that may arise.
14.7.7.3. Module review (10 minutes)

The facilitator leads the trainees 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 potato value chain.
- Women empowerment in potato value chain.
- Strategies for inclusion of vulnerable and marginalized groups in potato value chain.
- Socio-cultural barriers in the value chain.
- Environmental and socioeconomic impacts of potato activities

Let the trainees recall what they learned and discuss any issue that may arise.

14.8 Participants’ handouts

Annex 1: General reference materials


Kenya Climate Smart Agriculture Project (KCSAP)
P.O. Box 57811, City Square, Nairobi, 00200, Kenya