



Kenya Climate Smart
Agriculture Project



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

TRAINING OF TRAINERS' MANUAL



Onyango T., Wandera F.P., Nyambati E., Mugambi J., Mathai N., Mbugua D., Nguru J., Ayako W., Muia J., Kanegeni N.N., Waineina R., Nakeel M., Mutisya W., Ilatsia E., Muia J., Leparmarai P., Ouko R., Serem R., Gachina W. and Macharia E.

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Disclaimer

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FOREWORD

Kenya Climate-Smart Agriculture Project (KCSAP) tasked the Kenya Agricultural & Livestock Research Organization (KALRO) with the implementation of the project Component 2, on ‘Strengthening Climate-Smart Agricultural Research and Seed Systems’. The component activities are geared towards the development, validation, adoption and delivery of context specific climate smart agriculture (CSA) technologies, innovation and management practices (TIMPS). The other responsibility was development of sustainable seed production and distribution systems for priority value chains to enhance availability and access to seed, breeds and fingerlings by target beneficiaries under Components 1 (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 content are arranged in progressive modules supported by extensive information from research information and background data drawn from the TIMPS. Their relevance are based on the needs teased out of the value chains and the project objectives. The ToT Manuals training design takes into consideration the delivery system, the partners and their roles, the duration of training and logical flow of the sessions. Similar content requiring similar delivery systems are grouped together while the roles of the partners are tapped in the training and planning of the training sessions.

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

It is highly advised that the ToT Manuals should be used in conjunction with the respective value chains’ TIMPs documents and facts sheets in order to provide valuable resource for both public and private extension service providers. The use of this Manual is expected to 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

PREFACE

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

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

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

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

The National Project Coordination Unit is grateful to all who participated in the development and production of this *Training of Trainers' (ToT) Manual for dairy 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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List of Abbreviations and Acronyms

AEZ	Agro-Ecological Zones
AHITI	Animal Health and Industry Training Institute
AI	Artificial Insemination
ART	Assisted Reproduction Technology
ASALS	Arid and Semi-Arid Lands
CCT	County Coordination Teams
CD	Compact Disc
CSA	Climate Smart Agriculture
CTT	Core Team of Trainers
DRI	Dairy Research Institute
DTI	Dairy Training Institute
ES	Estrus Synchronization
FFBS	Farmer Field and Business Schools
GHG	Green House Gases
HMC	Home-Made Concentrates
KALRO	Kenya Agricultural and Livestock Research Organization
KDB	Kenya Dairy Board
LCD	Liquid Crystal Display
LF	Lead Farmer
MoAL&F	Ministry of Agriculture, Livestock and Fisheries
NPCU	National Project Coordination Unit
PDF	Portable Document Format
SNV	Netherlands Development Organization
TIMPs	Technologies, Innovations and Management Practices
TMR	Total Mixed Ration
ToT	Training of Trainers

PART I

This part consists of four sections including the background, module training content, training design and facilitator guidelines.

SECTION 1: BACKGROUND

1.1 The Role of Dairy in the Kenyan Economy

The dairy sub-sector in Kenya is considered one of the most developed in Sub-Saharan Africa. At the national level, this sector contributes 3.5% of the total GDP. The current milk output is estimated at 5.2 billion litres per annum, out of which 60% is from grade dairy cattle and their crosses while the remaining 40% comes from zebu, camel and goats. The national dairy herd is estimated at 3.3 million heads, majority of which are grade cattle. Smallholder farmers account for about 2.5 million dairy cows, producing over 80% of total national milk output. Of the total milk produced, about 60% is marketed through traders, cooperatives, hotels and kiosks. An estimated 84% of the milk produced is sold in raw form. It is further estimated that, in the entire milk commodity chain, from producers (farmers) to milk hawkers, nearly one million households and businesses are involved. Today, informal milk sector accounts for more than 70% of the 40,000 jobs in dairy marketing alone and further directly supports over 350,000 others in formal employment. Considering that there are nearly one million smallholder farmers, for whom dairy is a family business, it is likely that more than two million people derive livelihood from the dairy sector.

However, despite the plausible performance, Kenya's dairy industry is bedeviled by several challenges, of which inadequate feed, prevalence of diseases (especially tick-borne), availability of quality replacement stock, low adoption of technologies, high cost of farm inputs (including fodder/pasture seeds) and low milk value addition among dairy producers, are the most critical.

1.2 The Role of Dairy in Food and Nutrition Security

Food and nutrition security refers to a situation where all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Food security therefore encompasses availability of adequate quantities of a diversity of food commodities such as cereals, fruits, vegetables and animal products. Currently over 10 million people in Kenya suffer from chronic food insecurity and poor nutrition, and between two and four million people require emergency food assistance at any given time. Food safety is critical to good health and nutrition status.

Dairying contributes positively to human wellbeing in a variety of ways: nutrition through quality food products, income and employment, organic fertilizer as well as assets and savings. Nearly 30% of children in Kenya are classified as undernourished, and micronutrient deficiencies are widespread. Milk is regarded as a whole food, providing energy, protein, vitamins and minerals in human diet. It can therefore correct for malnutrition and nutrient deficiencies especially in children and young adults.

1.3 Climate Smart perspective in Dairy

Technologies, innovations and management practices (TIMPs) have been developed through research to address some of the challenges in dairy farming along the value chain. They address breeding, animal health, feeds and feeding, value addition and manure management. Some of the TIMPs include: assisted reproduction technologies (ART) in dairy breeding, disease tolerant basal and supplementary forages, forage conservation technologies, feed rations for maintenance and milk production, fortification of feeds, milk value addition and manure management.

1.4 Objectives of the Training

The purpose of this training is to provide the Master trainers with knowledge and skills on dairy cattle management focusing on breeding management, animal health, efficient feeds production, budgeting and utilization, milk handling and processing. Other areas include dairy business management, marketing and social and environmental concerns in dairy farming and trade.

After the 10 days training, the farmer trainers will facilitate training of Lead Farmers (LF) for implementing the dairy TIMPs. The lead farmers shall thereafter up scale the training in their villages and those neighbouring them.

SECTION 2: TRAINING MODULE CONTENT

2.1 Orientation of the Modules

The training content is organized into **(9) modules**, with a total of **78 sessions**, exclusive of introduction and review.

2.2 Modules Outline

Each of the nine modules has an outline consisting of eight parts as follows:

- a) Introduction to the module – context and background to training needs, knowledge and skills gaps being addressed
- b) Module learning outcomes – what trainees are expected to learn
- c) Module target group-trainee categories
- d) Module users –facilitators
- e) Module duration –minimum number of hours of exposure to materials
- f) Module summary –sequence of sessions, training methods, materials and duration
- g) Facilitators guideline –detailed sessions, training methods, materials and session guides
- h) Participants’ handouts – detailed notes and reference materials for trainees

The **9** modules are outlined in Table 1.

Table 1: Outline of the 10 modules

SECTION 3: THE 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) A Core Team of Trainers (CTT) trains farmer trainers (service providers) as facilitators of a TOT course. This is done using this manual and modules contained therein.
 - b) Each of the Master trainers will facilitate farmers to acquire knowledge and skills in facilitating Farmer-led 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.

3.2 Partners and their Roles

The partners envisioned in this training plan are:

- a) **Core Team of Trainers** – Master trainers drawn from KALRO, Universities, Tertiary Institutions offering dairy courses (Universities, DTI, AHITI) and the State Department of livestock will facilitate initial training of farmer trainers. They will also provide mentorship to farmers’ trainers during the first year of LF training. They should also be available in the evaluation of the first round of LF training.
- b) **County Government (Department of Livestock)** –Master trainers and their supervisors referred to as County Coordination Teams (CCT) will take the role of LF trainers, mentors and coordinators at sub-County level. They will assist FFBS’s form partnership with stakeholders for sustainability. They should also support LFs form their networks.
- c) **Lead Farmer Networks** - Association of LFs in the target counties will train farmers and upscale TIMPs in future. Lead farmer networks and groups will conduct exchange visits to learn best practices in other project implementing counties.
- d) **Private Sector Service Providers** – Inputs suppliers, financial and business development service providers, market players and processors will partner and support growth of individuals or dairy farmer groups.

3.3 Training Duration

The proposed initial TOT course for Master trainers for **9** modules in the dairy value chain shall take a total of **80 hours 50 minutes** of the training period. This does not include break hours of mid-morning, afternoon and lunch breaks.

3.4 Logic of Design and Flow of Sessions

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 participant's 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; and, (6) Distribute handouts to the participants.

SECTION 4: FACILITATOR GUIDELINES

4.1 Preparation of Training Materials

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

- a) The facilitators should familiarize themselves and internalize the guidelines provided by this manual prior to the training;
- b) The stationery required should be available within the training institution 3 days before the training. These include name tags, writing materials, a paper punch and medium size box files for participants' handouts filling;
- c) Flip charts and good quality felt pens could be used interchangeably with LCD projections. Each participant will require one felt pen while the trainers will require two sets of felt pens;
- d) Visual aids like field equipment and tools should also be arranged in time before the sessions start;
- e) 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; and
- f) Copies of the modules shall be distributed at the end of each module.

4.2 Preparation of Training Venue and Sites

The training venue will include the training room, field demonstration sites and market areas.

- a) **Training Room** – should have adequate space for 25 participants seated in a semi-circle or U shape arrangement ensuring access and unobstructed view of the front. There should be adequate space for a desk and seats for 3 trainers preferably at the sides or at the back of the training room. There should also be a desk for the trainer, their training materials and LCD projector, flip charts holder and white wall to act as a projector screen.
- b) **Demonstration Site** – Should be within walking distance
- c) **Market Sites** – these include milk retail outlets (Shops, Kiosks and Supermarkets) wholesale and aggregation points and processing sites if any. The operators should be informed in advance about the visits. These should not be very far away preferably less than 10 minutes' drive distance.

4.3 The Trainees

The trainees who will participate are extension officers, lead farmers, educators, and researchers with an elaborate training background in extension and advisory services.

They will be drawn from public and private sector based on considerable experience in training farmers but with minimal facilitative advisory or technology transfer approaches. The trainer should, therefore, act more of a facilitator than a lecturer and draw out and build on their knowledge, skills and experience that they shall bring in. As a golden rule, facilitators should not lecture participants but facilitate and listen and let them feel like equals to each other and the CTT team members.

4.4 Training Program

The training program consists of the actual training modules. Health breaks should be considered when drawing the training program. The training program should preferably be based on the outline presented in **Annex 1** to allow the flow of ideas and topics. However, should the situation demand, the sequence and day of coverage for whole or parts of the modules can be modified to suit emerging requirements. The training program assumes that the trainees report on Sunday evening as the first day and leave ten days later on Friday afternoon or Saturday morning.

4.5 Training Methods

The training methods proposed for each session are suitable for adult learners and appropriate for addressing knowledge, skills and attitudes of the participants. The choice of the methods has been informed by the competency issues being addressed, available time 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 other participatory training methods. Table 2 presents a list of available training methods.

Table 2: Training methods

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

4.6 Planning Schedule and Guidance for ToT preparation

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

Table 3: Training Preparation

Duration to Training	Activities to be Done
Six weeks	Recruit master trainers, compose CTT, identify the practical demonstration sites
Four weeks	Send out invitation letters to participants and special guests detailing purpose, venue and program. Follow up on demonstration sites. Brief CTT members
Two weeks	Confirm names of participants; reproduce training materials for 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
Four days	Confirm training sites preparedness, prepare sitting arrangements, and brief assistants
One day	Arrange training room furniture, place materials, equipment and stationery on the tables. Arrange for the reception of trainees at residence proposed
On the first day	Arrange for the reception of trainees at the training venue. Ensure climate setting is done before the course is officially opened. This includes: <ul style="list-style-type: none"> • Registration • Welcome to the venue by host • Elaborate introduction of CTT and participants • Ground rules • Group formation

4.7 Evaluation of the Training

At the end of each module, participants will evaluate it through questionnaire (Table 4) while a final training evaluation will be carried out on the last day using questions in Table 5. Individual trainees will fill the evaluation forms without discussing with each other. The evaluation forms are then collected and analyzed by the CTT members. Time will also be allocated on the last day for each County to discuss and present their way forward.

Table 4: Individual Sample Evaluation Form

MODULE: _____

COUNTY _____

What new things did you learn from the topic?
What other important aspects/topics were omitted ?
Any other comments?

NB: Expand the form into one page to give enough room for comments

Table 5. Final evaluation of KCSAP piloting of dairy training of trainers' (TOT) manual

Venue: _____ **Dates** _____

Thank you for participating in the Dairy value chain ToT Training Workshop which has just ended. Kindly take a few minutes to complete this Evaluation Form and return it to the Training Coordinator. The information you provide will be used to improve on the planning, organization, and management of future workshops and training.

Tick once in the box for each category

1.0 Rate the training venue in terms of food and workshop facilities as:

Very Good Good Average Poor

2.0 How would you rate the ToT in attainment of your expectations:

Very Good Good Average Poor

3.0

3.0 Please indicate two things that you liked about this ToT:

3.1
3.2

4.0 Please indicate two things that you did not like about this ToT:

4.1

4.2

5.0 Suggest two things about the course you would like done differently in future

5.1

5.2

NB: Please provide adequate space in the rows for participants to comment**4.8 Facilitator's Training Notes and Reference Materials****4.8.1 Key references**

Two key references should be provided for each module plus a list of other relevant publications for reference.

4.8.2 Guide on the use of the information

The trainers will be advised to issue trainees with at most 2 publications for each of the training sessions. This is because if they go away with many publications in one visit, they may be overwhelmed with the material load and thus limit knowledge uptake. Also, some will just take away as many as they can if allowed.

The list of all individual publications will be stored and available as electronic copies – mainly PDFs. The service providers are strongly advised to keep these electronic copies on a memory stick, CD 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 General Dairy Farming Manual to be accompanied by two other publications e.g. information sheets, brochures, factsheets and poster. With subsequent training modules, they can develop their collection of publications.

PART II

This part consists of 9 modules namely: Dairy animal breeding and management; Dairy animal health, Feeds and feeding; Manure management for bioenergy and soil fertility improvement; Milk value addition; Dairy business, Cost-Benefit analysis and marketing; Cross-Cutting issues including Gender, Youth, Vulnerable and Marginalized Groups inclusion, Social and environmental performance assessment and group dynamics and cohesion. All modules will be divided into the following:

- 1.1. Introduction to the Module
- 1.2. Module Learning Outcomes
- 1.3. Module Target Group and Categories
- 1.4. Module Users
- 1.5. Module Duration
- 1.6. Module Summary
- 1.7. Facilitator Guidelines
- 1.8. Participants' Handouts

MODULE 1

DAIRY ANIMAL BREEDING AND MANAGEMENT

1.1 Introduction to the Module

The module exposes trainers to methods of crossbreeding to improve dairy breeds (cattle and goats) suitable for different production systems. In Kenya, dairy production falls under three systems that include intensive, semi intensive and extensive. Crossbreeding is mating between animals of different breeds or lines. The Friesian-Sahiwal cross bred in KALRO combines the hardiness of a zebu and high milk yield of an exotic breed making it suitable for most dairy agro-ecological zones (AEZs) in Kenya.

The different techniques used in assisted reproductive technologies (ART) include multiple ovulation, embryo transfer synchronized mating and artificial insemination.

Poor management of dairy goats and calves is one of the main problems facing the dairy sector. It is important to maintain hygiene through proper housing of goats. *Today's calf/kid is the cow/doe of tomorrow.*

1.2 Module Learning Outcomes

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

- a) Knowledge on the suitability of different dairy breeds (cattle and goats) in various AEZs acquired and shared.
- b) Information on the importance of crossbreeding and different cross breeding systems for dairy cattle and goats obtained and shared
- c) Information on the significance of the Friesian x Sahiwal crossbred and its suitability in various AEZs obtained and shared
- d) Knowledge on selection of dairy cows and does to participate in Estrus Synchronization (ES) / Artificial Insemination (AI) acquired and shared
- e) Information on hormonal therapy for ES for AI and natural mating obtained and shared
- f) Knowledge on reproductive diseases and their risks to ES/AI acquired and shared

- g) Knowledge on monitoring of ES/AI candidates and Pregnancy diagnosis attained and shared
- h) Knowledge on management and housing of calves and dairy goats acquired and shared

1.3 Module Target Group and Categories

This module targets County extension staff, private service providers and Lead farmers.

1.4 Module Users

This module is intended for use by Master trainers in dairy value chain who are members of the Core Team of Trainers (CTT).

1.5 Module Duration

The Module is estimated to take a minimum of 11 hours and 30 minutes.

1.6 Module Summary

DAIRY ANIMAL BREEDING AND MANAGEMENT			
Sessions	Training Methods	Training Materials	Time
1.6.1 Introduction, objectives, expectations	<ul style="list-style-type: none"> • Personal introduction • Plenary presentation 	<ul style="list-style-type: none"> • Flip charts • Projector • Laptop • Participants' Handouts 	30 minutes
1.6.2 Introduction to animal breeding	<ul style="list-style-type: none"> • Presentation • Discussion 	<ul style="list-style-type: none"> • Projector • Laptop 	1 hour
1.6.3 Selection and crossbreeding	<ul style="list-style-type: none"> • Discussion • Presentation 	<ul style="list-style-type: none"> • Projector • Laptop • Flip charts, felt pens 	1 hour and 30 minutes
1.6.4 Friesian x Sahiwal crossbred	<ul style="list-style-type: none"> • Presentation • Discussion 	<ul style="list-style-type: none"> • Projector • Flip charts, felt pens 	30 minutes
1.6.5 Introduction to ART protocols	<ul style="list-style-type: none"> • Presentation • Discussions 	<ul style="list-style-type: none"> • Projector • Laptop • Flip chart, participants' handouts 	1 hour

1.6.6 Selection of candidates for ES/AI and heat detection	<ul style="list-style-type: none"> • Presentation • Discussion 	<ul style="list-style-type: none"> • Projector • Laptop • Flip charts, felt 	1 hour and 30 minutes
1.6.7 Hormonal therapy for Estrus Synchronization for use of AI and the bull/buck	<ul style="list-style-type: none"> • Discussions • Presentation 	<ul style="list-style-type: none"> • Participants' handouts • Flip chart • Video 	1 hour and 30 minutes
1.6.8 Reproductive diseases and their risks to ES/AI/ bull/buck	<ul style="list-style-type: none"> • Discussion • Presentation 	<ul style="list-style-type: none"> • Participants' handouts • Projector • Laptop • Flip chart 	1 hour
1.6.9 Monitoring of ES/AI candidates and Pregnancy diagnosis	<ul style="list-style-type: none"> • Discussion • Presentation 	<ul style="list-style-type: none"> • Participants' handouts • Projector • Laptop • Flip chart 	1 hour and 30 minutes
1.6.10 Management of dairy goats (housing and other aspects)	<ul style="list-style-type: none"> • Discussion • Presentation 	<ul style="list-style-type: none"> • Participants' handouts • Projector • Laptop • Flip chart 	1 hour
1.6.11 Management of calf (housing and other aspects)	<ul style="list-style-type: none"> • Discussion • Presentation 	<ul style="list-style-type: none"> • Participants' handouts • Projector • Laptop • Flip chart 	1 hour
1.6.12 Module Review	<ul style="list-style-type: none"> • Discussion 	<ul style="list-style-type: none"> • Review questionnaire 	30 minutes
TOTAL	11 hours and 30 minutes		

1.7 Facilitator Guidelines

1.7.0 Dairy animal breeding and management	
1.7.1 Introduction and Levelling Expectations (30 minutes)	Session Guide
<p>Introduction</p> <p>The facilitator welcomes trainees to the module dairy animal breeding and management, then introduces him/herself by stating his/her profile and experience of working with farmers.</p> <p><i>(The facilitator invites the trainees to introduce themselves and state their expectation for the module).</i></p> <p>Module Objectives</p> <p><i>(The facilitator presents modules objectives)</i></p> <p>By the end of the module trainees should be able to :</p> <ul style="list-style-type: none"> • Understand the suitability of different dairy breeds (cattle and goats) in various Agro-Ecological Zones (AEZ) • Appreciate the importance of crossbreeding and different crossing breeding systems for dairy animals (cattle and goats) • Understand the Significance of Friesian X Sahiwal crossbred and its suitability in various AEZ • Explain the Selection of dairy cows and does to participate on (ES/AI) • Appreciate hormonal therapy for Oestrus Synchronization for AI and the bull • Identify reproductive diseases and their risks to ES/AI • Describe the monitoring of ES/AI candidates and Pregnancy diagnosis • Explain the management of calf and dairy goats on housing and other aspects 	<ul style="list-style-type: none"> • Summarize participants’ “expectations” and display them

1.7.2 Introduction to animal breeding (1 hour)	Session Guide
<p><i>(The facilitator should describe the main criteria to be considered during in animal breeding)</i></p> <p>PowerPoint presentation (30 minutes)</p> <p>The critical factors include: Breed suitability, land ownership/social issues, location, production system, availability of germplasm</p> <p>Discussion (30 minutes)</p> <p>Let the trainees recall what they learned and discuss any issue that may arise</p>	<p>PowerPoint presentation and discussion</p>
1.7.3 Selection and crossbreeding (1 hour and 30 min)	
<p><i>(The facilitator presents and leads the trainees in discussing different cross breeding procedures)</i></p> <p>PowerPoint presentation on: (1 hour)</p> <ul style="list-style-type: none"> - Desired dairy cows/doe characteristics - Desired bull/buck characteristics (Bull Catalogue) - Different crossbreeding systems in goats and cattle - Community based breeding program (Buck rotation) - Importance of animal registration with KLBA - Record keeping (breeding) <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss</p>	<p>PowerPoint presentation and discussion</p>

1.7.4 Friesian x Sahiwal crossbred (30 minutes)	
<p><i>(The facilitator leads the trainees on the importance of Friesian X Sahiwal crossbred)</i></p> <p>Present PowerPoint slides highlighting: (20 minutes)</p> <ul style="list-style-type: none"> • Production and reproduction performance • Suitability • Availability of germplasm <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<p>PowerPoint presentation and discussion</p>
1.7.5 Introduction to ART protocols (1 hour)	
<p><i>(The facilitator guides the trainees in identifying general guidelines for assisted reproductive technologies).</i></p> <p>General guidelines (30 minutes)</p> <ul style="list-style-type: none"> • Justification • Advantages • Challenges <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<p>PowerPoint presentation and discussion</p>
1.7.6 Selection of candidates for ES/AI and heat detection (1 hour and 30 min)	
<p><i>(The facilitator presents and leads the trainees in discussing the aspects of preparing herds for ART)</i></p> <p>Presentation on: (1 hour)</p> <ul style="list-style-type: none"> • Parity • Health status • Body condition • Cystic ovaries • History of infertility • Heat detection • Timely heat detection and AI • Records <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss</p>	<p>PowerPoint presentation and discussion</p>

1.7.7 Hormonal therapy for Estrus Synchronization for AI and the bull/buck (1 hour and 30 minutes)	
<p><i>(The facilitator presents and leads discussion on the use of hormones in ART)</i></p> <p>Presentation and Practical session on hormone application (1 hour)</p> <ul style="list-style-type: none"> • Assembling of candidates • Technical staff • Use of AI and timing • Use of the bull • Follow up <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss</p>	Presentation Practical and discussion
1.7.8 Reproductive diseases and their risks to ES/AI/bull/buck (1 hour)	
<p><i>(The facilitator presents and leads the trainees in discussing common reproductive diseases)</i></p> <p>Present PowerPoint slides (30 minutes) highlighting:</p> <ul style="list-style-type: none"> • True venereal • Post parturient diseases <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	PowerPoint presentation and discussion
1.7.9 Monitoring of ES/AI candidates and Pregnancy diagnosis 30 minutes)	
<p><i>(The facilitator presents and leads the trainees in discussing the monitoring of ES/AI candidates and pregnancy diagnosis)</i></p> <p>Present PowerPoint slides (20 minutes) highlighting:</p> <ul style="list-style-type: none"> • Follow up • Pregnancy diagnosis <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	PowerPoint presentation and discussion

1.7.10 Management of dairy goats (housing and other aspects) (1 hour)	Session Guide
<p><i>(The facilitator presents and leads the trainees in discussing the aspects of dairy goat management)</i></p> <p>Present PowerPoint slides (30 minutes) highlighting:</p> <ul style="list-style-type: none"> • Housing and other aspects <p>Discussion (30 minutes)</p> <p>After the presentation allow trainees to raise issue and discuss</p>	
1.7.11 Management of calf (housing and other aspects) (1 hour)	
<p><i>(The facilitator presents and leads trainees in discussing the aspects of dairy calf's management)</i></p> <p>Present PowerPoint slides (30 minutes) highlighting:</p> <ul style="list-style-type: none"> • Housing • Other aspects <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise issue and discuss.</p>	
1.7.12 Module review (20 minutes)	
<p><i>(The facilitator should let the trainees to present their views on each of the sessions covered under this module. On flip chart list and summarize the key points they should emphasize when training farmers)</i></p> <p>Review together the main points about dairy animal breeding and management by answering the following:</p> <ol style="list-style-type: none"> 1. <i>What new things did you learn from this topic?</i> 2. <i>What other important aspects/topics were omitted?</i> 3. <i>Any other comments</i> 	<p>Distribute handout and questionnaire on module review</p>

1.8 Participants' Handouts

1. Assisted reproductive technologies in dairy animals
2. Crossbreeding
3. Dairy Breeding Manual (Ministry of Livestock Development 2011)

4. Dairy breed development and germplasm multiplication
5. Evaluation of basic and alternative breeding programs for Sahiwal cattle genetic
6. Farm- Africa Dairy Goat production hand book
7. Friesian Sahiwal Crosses
8. Methods for diagnosis and monitoring of pregnancy in dairy cattle and their implementation
9. MoAL&F. 2014. Ministry of Agriculture, Livestock and Fisheries. Dairy Cattle Extension Manual. 151 pages
10. Record keeping
11. Reproductive diseases in animals
12. Selection of candidates for ES /AI and the bull/buck
13. Synchronization of estrus in dairy animals

MODULE 2

DAIRY ANIMAL HEALTH

2.1 Introduction to the Module

This module will address the concept of health and disease, disease causes, climate related diseases, pests/parasites in dairy cattle and goats. It will also address biosecurity measures at farm level, safe and effective use of veterinary drugs, vaccines and pesticides and integrated disease control methods with one health as a component. It will also address mastitis and milk contaminants, metabolic diseases as well as poisoning.

2.2 Module Learning Outcomes

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

- a) Knowledge on health and disease in dairy enhanced and shared
- b) Knowledge on climate related diseases, pests/parasites in dairy cattle, goats and camels enhanced and shared
- c) Knowledge on diagnosis and management of important animal diseases, pests/parasites affecting livestock productivity acquired and shared.
- d) Knowledge on safe handling and use of veterinary drugs, vaccines and pesticides to ensure effectiveness, food safety and environment conservation acquired and shared
- e) Knowledge on the application of integrated disease control strategies enhanced and shared

2.3 Target Group and Categories

This module targets Service providers who include County extension staff, private service providers and lead farmers.

2.4 Module Users

This module is intended for use by Master trainers in dairy value chain who are members of the Core Team of Trainers (CTT).

2.5 Module Duration

The module is estimated to take **8 hours 50 minutes**.

2.6 Module Summary

DAIRY ANIMAL HEALTH			
Sessions	Training Methods	Training Materials	Time (minutes)
2.6.1 Introduction to the module and leveling of expectations	<ul style="list-style-type: none"> - Buzz groups - Group Exercises 	<ul style="list-style-type: none"> - Handout of Module Objectives - Felt pens, masking tape or sticker glue, notebooks and pens - Laptop - Projector 	25 minutes
2.6.2 Concept of health and disease in farm animals	<ul style="list-style-type: none"> - Plenary presentation - Group Exercises 	<ul style="list-style-type: none"> - Flip charts, felt pens - Laptop - Projector 	1 hour 5 minutes
2.6.3 Causes of disease Requirements for keeping animals healthy	<ul style="list-style-type: none"> - Plenary presentation 	<ul style="list-style-type: none"> - Flip charts, felt pens - Laptop - Projector 	25 minutes
2.6.4 Climate related diseases and pests/parasites in dairy cattle, goats and camels	<ul style="list-style-type: none"> - Brainstorming - Plenary presentation - Group exercises 	<ul style="list-style-type: none"> - Flip charts and felt pens - Laptop - Projector - PowerPoint images of pests and diseases - Participants' handouts on dairy cattle, goat and camel pests and diseases 	1 hour 35 minutes
2.6.5 Biosecurity measures	<ul style="list-style-type: none"> - Brainstorming - Plenary presentation 	<ul style="list-style-type: none"> - Flip charts and felt pens - Laptop - Projector - Participants' handouts on products to use 	55 minutes

2.6.6 Mastitis and milk contaminants	<ul style="list-style-type: none"> - Group exercises - Plenary presentation 	<ul style="list-style-type: none"> - Flip charts, flash cards, felt pens - Laptop - Projector - participants' handouts on guidelines to reduce milk contaminants 	I hour
2.6.7 Metabolic diseases in dairy	<ul style="list-style-type: none"> - Plenary presentation 	<ul style="list-style-type: none"> - Laptop - Projector - Flip charts and felt pens - Participants' handouts 	20 minutes
2.6.8 Poisoning	<ul style="list-style-type: none"> - Brainstorming - Plenary presentation 	<ul style="list-style-type: none"> - Flip charts, flash cards, felt pens - Laptop - Projector - Participants' handouts on dairy goat diseases and pests/parasites 	35 minutes
2.6.9 Safe and effective use of veterinary drugs, vaccines and pesticides	<ul style="list-style-type: none"> - Brainstorming - Plenary presentation 	<ul style="list-style-type: none"> - Flip charts and felt pens - Laptop - Projector - Participants' handout on safe use of drugs 	1 hour 5 minutes
2.6.10 Integrated disease control	<ul style="list-style-type: none"> - Group exercises - Plenary presentation 	<ul style="list-style-type: none"> - Flip charts, flash cards, felt pens - Laptop - Projector - participants' handouts on an example of integrated disease control 	55 minutes
2.6.11 Review of module	Individual exercise	<ul style="list-style-type: none"> - Questionnaire for module review 	20 minutes
TOTAL			8 hours 50 minutes

2.7 Facilitator Guidelines

2.8 Participants' Handouts

1. Dairy Cattle Health Management: Training Package For Dairy Extension Workers
2. Effects of climate change on the occurrence and distribution of livestock diseases <http://dx.doi.org/10.1016/j.prevetmed.2016.11.019>
3. A field manual of animal diseases by syndromes [http://www.cldavis.org/ghpn/tools/syndromic_manual_en\[1\].pdf](http://www.cldavis.org/ghpn/tools/syndromic_manual_en[1].pdf)
4. Draft National Livestock, Policy, Kenya
<http://www.kilimo.go.ke/wp-content/uploads/2019/02/Draft-reviewed-National-Livestock-Policy-February-2019.pdf>

MODULE 3

FEEDS AND FEEDING

3.1 Introduction to the Module

This module will address challenges of inadequate and poor-quality feed resources which are encountered by dairy farmers, especially during the dry season. The training will cover appropriate dairy feed resources (pastures, established fodder including multi-purpose shrubs and legumes, concentrates, and minerals) that are suitable for different Agro-Ecological Zones (AEZs), agronomic practices to improve biomass yields and quality, pests and disease control methods, roles of protein-rich forages and tree pods, and concentrate supplements, quality enhancement of crop residues, feed conservation methods, feed quality and safety issues, feed budgeting, and record keeping for dairy feed resources.

3.2 Module Learning Outcomes

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

- a) Knowledge on different classes of dairy feed resources enhanced and shared
- b) Forage ecological suitability, agronomic management, and biomass yields explained and understood
- c) Factors affecting forage biomass yields explained and understood
- d) Knowledge of forage pests and diseases, causes and their control enhanced and shared
- e) Crop residues and the technologies to improve their quality explained and understood
- f) Knowledge on appropriate forage conservation technologies acquired and shared
- g) Knowledge on the roles of protein-rich forage and concentrate supplements acquired and shared
- h) Challenges of dairy feed quality and safety, and how to overcome them explained and understood
- i) Effects of anti-nutritive factors in dairy feeds, and the technologies to reduce the negative effects explained and understood
- j) Year-round budgeting of dairy feeds and keeping of dairy feed records explained and understood

3.3 Target Group and Categories

This module targets Service providers who include County extension staff, private service providers and lead farmers

3.4 Module Users

This module is intended for use by Master trainers in dairy value chain who are members of the Core Team of Trainers (CTT).

3.5 Module Duration

The Module is estimated to take a minimum of **10 hours**.

3.6 Module Summary

FEED RESOURCES			
Sessions	Training Methods	Training Materials	Time
3.6.1 Module outline, introduction, expectations, and objectives	- Presentation - Plenary	- Flip charts - Projector - Laptop	30 minutes
3.6.2 Classification of feed resources	- Presentation - Discussions	- Flip charts - Projector - Laptop - Participants' handouts	30 minutes
3.6.3 Forage ecological suitability, agronomic management, and biomass yields	- Presentation - Discussions - Displays	- Flip charts - Projector - Laptop	1 hour 30 minutes
3.6.4 Factors affecting forage biomass yield and quality	- Presentation - Discussion	- Flip charts - Projector - Laptop	30 minutes
3.6.5 Forage pests and diseases	- Presentation - Discussion	- Flip charts - Projector - Laptop - Participants handouts	1 hour
3.6.6 Crop residues	- Presentation - Discussion - Displays - Demonstrations - Practical	- Flip charts - Projector - Laptop - Participants' handouts	1 hour 30 minutes

3.6.7 Protein-rich forage and concentrate supplements	<ul style="list-style-type: none"> - Presentation - Displays - Discussions 	<ul style="list-style-type: none"> - Projector - Laptop - Flip charts - Participants' handouts 	30 minutes
3.6.8 Anti-nutritive factors in dairy feeds	<ul style="list-style-type: none"> - Presentation - Discussion - Displays - Demonstrations 	<ul style="list-style-type: none"> - Projector - Laptop - Participants' handouts 	30 minutes
3.6.9 Forage conservation	<ul style="list-style-type: none"> - Presentation - Demonstrations - Practical - Discussions 	<ul style="list-style-type: none"> - Projector - Laptop - Flip charts - Participants' Handouts 	1 hour
3.6.10 Dairy feeds quality and safety	<ul style="list-style-type: none"> - Presentation - Discussion - Displays - Demonstrations - Group exercise 	<ul style="list-style-type: none"> - Projector - Laptop - Flip charts - Participants' Handouts 	30 minutes
3.6.11 Budgeting of dairy feed Keeping of dairy feed records	<ul style="list-style-type: none"> - Presentation - Discussion - Displays - Demonstrations - Practical Exercise 	<ul style="list-style-type: none"> - Projector - Laptop - Flip charts - Participants' handouts 	1 hour
3.6.12 Keeping of dairy records	<ul style="list-style-type: none"> - Presentation - Discussion - Displays - Demonstrations 	<ul style="list-style-type: none"> - Projector - Laptop - Flip charts - Participants' handouts 	30 minutes
3.6.13 Module Review	<ul style="list-style-type: none"> - Individual exercise 	<ul style="list-style-type: none"> - Review questionnaire 	30 minutes
TOTAL			10 hours

3.7 Facilitator Guidelines

3.7.0 Feed Resources	
3.7.1. Introduction and Levelling Expectations (30 minutes)	Session Guide
<p>Introduction</p> <p>The facilitator welcomes trainees to the module on dairy feed resources and introduces him/herself by stating his/her profile and experience of working with farmers.</p> <p><i>(The facilitator invites the trainees to state their expectation for the module).</i></p> <p>Module Objectives</p> <p><i>The facilitator presents modules objectives</i></p> <p>By the end of the module the trainees should be to:</p> <ul style="list-style-type: none"> - Describe different classes of dairy feed resources - Understand and explain forage ecological suitability, agronomic management, and biomass yields - Describe factors affecting forage biomass yields and quality - Identify and describe forage pests and diseases, causes and their control - Explain crop residues and their quality improvement technologies - Understand forage conservation technologies - Describe the protein-rich forage and concentrate supplements - Explain dairy feeds quality and safety, and the affecting factors - Describe the dairy feed anti-nutritive factors, their effects, and the methods to reduce the effects - Understand budgeting of dairy feeds and keeping of feed records 	<ul style="list-style-type: none"> • Summarize Participants’ “Expectations” and display. • PowerPoint presentation • Participants exercise • Participants flip chart presentations

3.7.2 Classification of dairy feed resources (30 minutes)	
<p><i>The facilitator presents and guides trainees in the discussion on the importance of classifying the various feed resources.</i></p> <p>Presentation and discussion (20 minutes)</p> <p>Present and discuss roles, attributes, and classification by types:</p> <ul style="list-style-type: none"> - Roughages - Concentrates - Minerals - Feed additives <p>Present and discuss roles, attributes and classification by nutrients:</p> <ul style="list-style-type: none"> - Protein-rich feed resources - Carbohydrate (energy)-rich feed resources - Mineral-rich feed resources <p>Present and discuss roles, attributes and classification by origin:</p> <ul style="list-style-type: none"> - Feed resources of animal origin - Feed resources of crop origin - Industrial by-products <p>Present and discuss roles, attributes and classification by their use:</p> <ul style="list-style-type: none"> - Basal forages - Complementary forages - Supplementation <p>Discussion (10 minutes)</p> <p>After presentation allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

<p>3.7.3 Forage ecological suitability, agronomic management, and biomass yields (1 hour and 30 minutes)</p>	
<p><i>The facilitator leads trainees in identifying suitable forages for different AEZs, their agronomic practices, and biomass yields.</i></p> <p>Presentation and practical Exercise (1 hour)</p> <ul style="list-style-type: none"> - Effect of climate change on forage production - Forages suitable for different AEZs (soil conditions, altitude, temperature, annual rainfall) - Agronomic management (land preparations, seed rates, fertilization, weeding, harvesting) for different forages - Biomass yields of different forages - Demonstrations on agronomic practices and estimation of biomass yields (quadrant, actual harvesting, number of plants per unit area) <p>Discussion (30 minutes)</p> <p>After the presentations and demonstrations sessions allow trainees to raise any issues and discuss.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion • Practical Exercise
<p>3.7.4 Factors affecting forage biomass yields and quality (30 minutes)</p>	
<p><i>The facilitator presents and leads the trainees in discussing the factors affecting biomass yield and quality of forages</i></p> <p>Presentation (20 minutes)</p> <ul style="list-style-type: none"> - Choice of forage - Agronomic practices - Pests and diseases - Timing of harvesting - Prevailing weather conditions <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

3.7.5 Forage pests and diseases (1 hour)	
<p>Presentation (30 minutes) <i>The facilitator presents and leads discussion on common pests and diseases affecting forages, and their causes and control</i></p> <ul style="list-style-type: none"> - Common forage pests and diseases - Economic importance of forage pests and diseases - The predisposing factors to forages pests and diseases - Forage pests and diseases control measures <p>Discussion (30 minutes) After the presentations allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary Discussion
3.7.6 Crop residues (1 hour and 30 minutes)	
<p>Presentation and demonstration (1 hour) <i>The facilitator presents and leads discussion on common crop residues and how to improve their quality for dry season feeding of dairy animals.</i></p> <ul style="list-style-type: none"> - Common crop residues and their attributes - The opportunities and challenges of enhancing the quality of crop residues - How to enhance the quality of crop residues through treatment technologies - Total mixed ration blocks (TMRBs) and their attributes <ul style="list-style-type: none"> - Urea-molasses-mineral blocks (UMMBs) supplements and their characteristics - Demonstrations on how to enhance the quality of crop residues at the farm level <p>Discussion (30 minutes) After the presentations allow participants to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion • Practical demonstration

3.7.7 Protein-rich forage and concentrate supplements (30 minutes)	
<p><i>The facilitator presents and leads discussion on the different supplements including protein-rich forages and concentrates and their attributes</i></p> <p>Presentation (20 minutes)</p> <ul style="list-style-type: none"> - The availability and costs of dairy feed supplements - The role of supplements (concentrates and protein-rich forages) in dairy productivity - The role of feed additives in dairy productivity <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
3.7.8 Anti-nutritional factors in dairy feeds (30 minutes)	
<p><i>The facilitator presents and leads discussion on the importance of anti-nutritive factors in feed resources when feeding dairy cattle.</i></p> <p>Presentation (20 minutes)</p> <ul style="list-style-type: none"> - Importance of anti-nutritive factors in feeding - Types and levels of anti-nutritive factors in feed resources (tannins, saponins, phenols, mimosine, alkaloids, trypsin, cyanide, gossypol) - Methods of reducing the anti-nutritive factors in feed resources <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

3.7.9 Forage conservation (1 hour)	
<p><i>The facilitator presents and leads discussion on the different forage conservation technologies and their applications</i></p> <p>Presentation and demonstration (1 hour)</p> <ul style="list-style-type: none"> - The current forage conservation status - The opportunities and challenges of forage conservation at farm level - Methods of forage harvesting and curing - Forage conservation techniques (hay box, polythene tube silage) - Structures required for storage of conserved forages - Demonstrations on how to conserve forages at farm level <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion • Practical demonstration
3.7.10 Dairy feed quality and safety (30 minutes)	
<p><i>The facilitator presents and leads discussion on the importance and assessment of feed quality and safety</i></p> <p>Presentation (20 minutes)</p> <ul style="list-style-type: none"> - Economic importance of poor quality and unsafe dairy feeds - Dairy feed quality and safety concerns and issues in Kenya - Methods of assessing feed quality and safety - Regulations and policies in control regarding the quality and safety of feeds (HACCP, GMP, GAPs) - Available facilities for analysis of feed quality and safety (KALRO, Universities, KEBS, GoK chemists) <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

3.7.11 Budgeting of dairy feeds (1 hour)	
<p><i>The facilitator presents and leads discussion on quantifying feed budgets for year-round feeding of dairy cattle.</i></p> <p>Presentation and exercises (30 minutes)</p> <ul style="list-style-type: none"> - Estimation of all dairy animal feed requirements for maintenance, reproduction, and production annually - Estimation with a safety margin of total quantities of feed required annually - Conversion of dry matter to fresh weight and vice versa - Estimation of quantities of forages and concentrates required annually - Estimation of land required to produce forages for the dairy animals - Estimation of costs - Demonstration using graphs and bar charts to show feed supply and demand in all months of the year - Exercise on the budgeting of dairy feeds <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion • Practical exercise
3.7.12 Keeping of dairy feed records (30 minutes)	
<p>Presentation (20 minutes)</p> <p><i>The facilitator presents and leads discussion on the importance of keeping good dairy feed records.</i></p> <ul style="list-style-type: none"> - Importance of records in feed budgeting and planning - Feed record, labelling and traceability issues - Types of feed records to be kept (yield, sales, input costs) - Management of the records - Monitoring and evaluation of the profitability of the feed resource enterprise <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion • Practical exercise

3.7.13 Module review (30 minutes)	
<p><i>(The facilitator should let the trainees present their views on each of the sessions covered under this module. On flip chart list and summarize the key points they should emphasize when training farmers)</i></p> <p>Review the main points about dairy feed resources by answering the following:</p> <ol style="list-style-type: none"> 1. <i>What new things did you learn from this topic?</i> 2. <i>What other important aspects/topics were omitted?</i> 3. <i>Any other comments</i> 	Distribute handout and questionnaire on module review

3.8 Participants' Handouts

This is a short guide for dairy farmers to familiarize themselves with the range of publications and information on feed resources

1. KALRO pasture and fodder common in the cold highlands
2. Farmers' training manual on sweet lupin production and management
3. Cassava based Napier grass silage pamphlet
4. Tree Lucerne for livestock feeding pamphlet
5. Sunflower cake for livestock feed ration pamphlet
6. Grow fodder sorghum for increased milk yield pamphlet
7. Stop the spread of Napier stunt disease pamphlet
8. Lucerne, a practical guide to production
9. Ogillo, *et al.* 2016. Leaflet on Hay making and storage available in: www.kalro.org/asal-aprp/
10. MoAL&F. 2014. Ministry of Agriculture, Livestock and Fisheries. Dairy Cattle Extension Manual. 151 pages

MODULE 4

FEED FORMULATION

4.1 Introduction to the Module



Mixing feeds (left) resources (right) and feeding

This module provides information on the formulation of least cost dairy ration options based on locally available feed resources. Nutritionally balanced dairy rations, formulated using appropriate feed formulation software, would help smallholder dairy farmers improve dairy productivity, food security, household income, employment opportunities and reduce production costs. These rations would also minimize feed wastage and environmental pollution through reduction of greenhouse gas emissions and element fluxes. The manual is also aimed at equipping dairy extension officers with adequate information and knowledge in dairy rations formulation for them to train farmers effectively.

4.2 Module Learning Outcomes

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

- a) Knowledge on nutrient requirements of dairy cattle and goats enhanced and shared
- b) Information on requirements for formulate dairy feed rations acquired and shared
- c) Knowledge on nutrient balanced dairy feed rations and the requirements for formulation of dairy feed rations attained and shared
- d) Guidelines on formulation of dairy feed rations accessed and shared
- e) Knowledge on dairy feeds ration formulation methods attained and shared

- f) Knowledge on formulation of home-made concentrates and total mixed feed rations acquired and shared
- g) Knowledge on feed mill equipment, capacities and their estimated costs enhanced and shared

4.3 Target Group and Categories

This module targets County extension staff, private service providers and lead farmers

4.4 Module Users

This module is intended for use by Master trainers in dairy value chain who are members of the Core Team of Trainers (CTT).

4.5 Module Duration

The Module is estimated to take a minimum of **6 hours 30 minutes**.

4.6 Module Summary

FEED FORMULATION			
Sessions	Training Methods	Training Materials	Time
4.6.1 Module outline, introduction, expectations, and objectives	<ul style="list-style-type: none"> - Presentation - Plenary - Discussion 	<ul style="list-style-type: none"> - Flip charts/ felt pens - Projector - Laptop - Participants handouts 	30 minutes
4.6.2 Nutrient requirements of dairy cattle and goats	<ul style="list-style-type: none"> - Presentation - Demonstration - Plenary - Discussion 	<ul style="list-style-type: none"> - LCD projector - Laptop - Flip charts/ felt pens 	30 minutes
4.6.3 Information required to formulate dairy feed rations	<ul style="list-style-type: none"> - Presentation - Demonstration - Plenary - Discussion 	<ul style="list-style-type: none"> - LCD projector - Laptop - Flip charts/ felt pens 	30 minutes
4.6.4 Nutrient balanced dairy feed rations	<ul style="list-style-type: none"> - Presentation - Demonstration - Discussion 	<ul style="list-style-type: none"> - Flip charts/ felt pens - Projector - Laptop 	30 minutes
4.6.5 Guidelines for the formulation of dairy feed rations	<ul style="list-style-type: none"> - Presentation - Demonstration - Discussion 	<ul style="list-style-type: none"> - Flip charts/ felt pens - Projector - Laptop 	30 minutes

4.6.6 Dairy feeds ration formulation methods	<ul style="list-style-type: none"> - Presentations - Demonstration - Discussion - Group assignments 	<ul style="list-style-type: none"> - Projector - Laptop - Participants handouts - Feed formulation guides 	1 hour 30 minutes
4.6.7 Formulation of TMRs and Home-made concentrates	<ul style="list-style-type: none"> - Presentation - Discussion - Group work - Practical Exercise 	<ul style="list-style-type: none"> - Projector - Laptop - Flip charts/ felt pens 	30 minutes
4.6.8 Exercise on the formulation of Total Mixed Rations(TMRs)	<ul style="list-style-type: none"> - Practical Exercise - Discussion 	<ul style="list-style-type: none"> - Weighing scale - Concentrate ingredients - Forages - Shovels - Packaging materials 	30 minutes
4.6.9 Feed mill equipment, capacities and their cost. (Utafiti Feed mill, DRI Naivasha)	<ul style="list-style-type: none"> - Presentations - Discussion 	<ul style="list-style-type: none"> - Projector - Laptop - Photos 	30 minutes
4.6.10 Practical mixing of HMCs (manual, automated)	<ul style="list-style-type: none"> - Practical Exercise - Discussions 	<ul style="list-style-type: none"> - Weighing scale - Concentrate ingredients - Shovels - Packaging materials 	30 minutes
4.6.11 Practical mixing of TMRs (manual, automated)	<ul style="list-style-type: none"> - Practical Exercise - Discussion 	<ul style="list-style-type: none"> - Weighing scale - Concentrate ingredients - Forages - Shovels - Packaging materials 	30 minutes
4.6.12 Module Review	<ul style="list-style-type: none"> - Individual exercise 	<ul style="list-style-type: none"> - Review questionnaire 	30 minutes
TOTAL			6 hours 30 minutes

4.7 Facilitator Guidelines

4.7.0 Feed formulation	
4.7.1 Introduction and Levelling Expectations (20 minutes)	Session Guide
<p>Introduction</p> <p>The facilitator welcomes trainees to the module feed formulation.</p> <p><i>(The facilitator invites the trainees to state their expectation for the module).</i></p> <p>Module Objectives</p> <p>The facilitator presents modules objectives</p> <p>By the end of the module participants should be able to:</p> <ul style="list-style-type: none"> - Explain Nutrient requirements of dairy cattle and goats - Explain nutrient balanced dairy feed rations and the requirements for formulation of dairy feed rations. - Understand the guidelines for the formulation of dairy feed rations - Describe the dairy feeds ration formulation methods - Explain the formulation of home-made concentrates and total mixed feed rations - Describe feed mill equipment, capacities and their estimated costs 	<ul style="list-style-type: none"> • Summarise participants’ “expectations” and display. • PowerPoint presentation • Participants exercise • Participants flip chart presentations

4.7.2 Nutrient requirements of dairy cattle and goats (30 minutes)	
<p><i>The facilitator explains what the feed standards/nutrient requirements are and their uses in benchmarking dairy feed formulation.</i></p> <p>Presentation (20 minutes) on:</p> <ul style="list-style-type: none"> - Concept of dry matter in the feeding of dairy animals - Guideline for dry matter intake of dairy animals - Factors affecting dry matter intake of dairy animals - Guideline for water requirements of dairy animals - Factors influencing water intake by dairy animals - The feeding standards for different classes of dairy cattle - The feeding standards for different classes of dairy goats <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary Discussion

4.7.3 The information required to formulate dairy feed rations (30 minutes)	
<p><i>The facilitator presents and leads discussion on information required to formulate feed rations</i></p> <p>Plenary Presentation (20 minutes) on:</p> <p>Animal factors:</p> <ul style="list-style-type: none"> - Estimation of live-weight using girth band, ordinary tape - Dairy animal performance (growth, milk production, foetus) <p>Feed factors:</p> <ul style="list-style-type: none"> - Feed quality (feed library) - Feed costs - Availability <p>Equipment:</p> <ul style="list-style-type: none"> - Formulation software - Weighing scales - Shovel/ mixer - Machine for mixing <p>Formulator:</p> <ul style="list-style-type: none"> - Education level - Skills and knowledge on feed formulation - Willingness and interest to formulate <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

4.7.4 Nutrient balanced dairy feed rations (30 minutes)	
<p><i>The facilitator presents and leads discussion on the role and benefits of nutrient balanced rations for dairy animal feeding and safe environment.</i></p> <p>Presentation (20 minutes) on:</p> <ul style="list-style-type: none"> - The difference between a ration and a diet - Consequences of feeding nutrient imbalance dairy feed rations - Importance of nutrient balanced rations - Nutrient balanced home-made concentrate - Nutrient balanced feed rations <p>Discussion (10 minutes)</p> <p>After the presentations allow participants to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
4.7.5 Guidelines for the formulation of dairy feed rations (30 minutes)	
<p><i>The facilitator presents on guidelines for formulation of dairy feed rations.</i></p> <p>Presentation (20 minutes) on:</p> <ul style="list-style-type: none"> - General guidelines on compounding concentrates - General guidelines on compounding TMRs <p>Discussion (10 minutes)</p> <p>After the presentations allow participants to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
4.7.6 Dairy feeds ration formulation methods (1 hour 30 minutes)	
<p><i>The facilitator presents and leads trainees in discussing the various methods used in feed formulation to arrive at the desired feed ration that meets the dairy animal needs.</i></p> <p>Presentation (1 hour) on:</p> <ul style="list-style-type: none"> - Pearson square - Excel spreadsheet trial and error - Excel spreadsheet solver - PC Dairy <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

4.7.7 Exercise on the formulation of concentrates (30 minutes)	Session Guide
<p><i>The facilitator guides trainees in their exercises on formulating nutrient balanced home-made concentrates.</i></p> <p>Exercise (20 minutes) The participants will gain experience on how to formulate home-made concentrate using available raw materials</p> <p>Discussion (10 minutes) After the exercise, allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • Practical exercise • Plenary discussion
4.7.8 Exercise on the formulation of total mixed rations (TMRs) (30 minutes)	
<p><i>The facilitator guides trainees in their exercises on formulating least-cost nutrient balanced total mixed rations.</i></p> <p>Exercise (20 minutes) The trainees will gain experience on how to formulate least-cost and nutrient balanced TMR using locally available feed resources</p> <p>Discussion (10 minutes) After the exercise, allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • Practical exercise • Plenary discussion
4.7.9 Feed mill equipment, capacities and their estimated costs (30 minutes)	
<p><i>The facilitator presents on the various equipment used in feed mills, their capacities and estimated costs.</i></p> <p>Presentation on: (20 minutes)</p> <ul style="list-style-type: none"> - Various equipment (hammer mill, mixers, weighing scales, packaging etc.), used for commercial feed manufacturing their capacities and costs - Various equipment (drums, spades etc.) used for small scale mixing of feeds at farm level <p>Discussions (10 minutes) After the presentation allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • Practical exercise • Plenary discussion

4.7.10 Practical mixing of HMCs (30 minutes)	Session Guide
<p><i>The facilitator guides the trainees in the practical session on mixing rations using the formulations derived from activity 4.7.7 above.</i></p> <p>Practical session (20 minutes)</p> <p><i>The facilitator will guide trainees during the actual mixing of the formulated concentrate</i></p> <p>Discussion (10 minutes)</p> <p>After the mixing the concentrate, allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • Practical exercise • Plenary discussion
4.7.11 Practical mixing of total mixed rations (TMRs) (30 minutes)	
<p><i>The facilitator guides trainees on mixing a total mixed ration (TMR) using the formulations derived from activity 4.7.8 above.</i></p> <p>Practical Exercise (20 minutes)</p> <p><i>The facilitator will guide trainees during the actual mixing of the formulated TMRs</i></p> <p>Discussion (30 minutes)</p> <p>After the mixing of TMRs allow trainees to raise any issue and discuss</p>	<ul style="list-style-type: none"> • Practical Exercise • Plenary Discussion
4.7.12 Module review (30 minutes)	
<p><i>(The facilitator should let the trainees to present their views on each of the sessions covered under this module. On flip chart list and summarize the key points they should emphasize when training farmers)</i></p> <p>Review the main points about dairy feeding by answering the following:</p> <ol style="list-style-type: none"> 1. <i>What new things did you learn from this topic?</i> 2. <i>What other important aspects/topics were omitted?</i> 3. <i>Any other comments</i> 	<p>Distribute handouts and questionnaire</p>

4.8 Participants' Handouts

- 1 Guidelines for the formulation of dairy cattle feed rations using PC Dairy software

- 2 Guidelines for the formulation of feed rations using Excel Solver software
- 3 Feeding standards for dairy cattle
- 4 Feeding standards for dairy goats
- 5 Total mixed rations for dairy cattle in Muranga Counties
- 6 Total mixed rations for dairy cattle in Machakos Counties
- 7 MoAL&F. 2014. Ministry of Agriculture, Livestock and Fisheries. Dairy Cattle Extension Manual. 151 pwages

MODULE 5

FEEDING

5.1 Introduction to the Module

This module will address appropriate dairy feeding practices that ensure all classes of dairy animals are fed adequately for both maintenance, production, and reproduction. Similarly, it will address the feeding of basal forages (pastures and fodder), supplements (supplementary forages, concentrates and minerals) and water.

5.2 Module Learning Outcomes

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

- a) Guidelines for feeding dairy cattle and goats explained and understood
- b) Knowledge on early weaning diets for calves enhanced and shared
- c) Knowledge on use of alternative milk replacers in calf rearing enhanced and shared
- d) Knowledge on supplementation to improve performance of dairy cattle and goats enhanced and shared.
- e) Use of sweet potato vines as a milk replacer for kids explained and understood

5.3 Target Group and Categories

This module targets County extension staff, private service providers and lead farmers

5.4 Module Users

This module is intended for use by Master trainers in dairy value chain who are members of the Core Team of Trainers (CTT).

5.5 Module Duration

The module is estimated to take **4 hours 30 minutes**.

5.6 Module Summary

FEEDING			
Sessions	Training Methods	Training Materials	Time
5.6.1 Module outline, introduction, expectations, and objectives	<ul style="list-style-type: none"> - Presentation - Plenary 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop 	30 minutes
5.6.2 Feeding of calves			
5.6.3 Early weaning of calves using milk replacers and protein-rich forages	<ul style="list-style-type: none"> - Presentation - Discussions 	<ul style="list-style-type: none"> - Flip charts - LCD projector - Laptop - Participants' Handouts 	30 minutes
5.6.4 Feeding technologies for heifers	<ul style="list-style-type: none"> - Presentation - Discussion 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	30 minutes
5.6.5 Feeding technologies for lactating cows	<ul style="list-style-type: none"> - Presentation - Discussions 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	30 minutes
5.6.7 Feeding technologies for kids	<ul style="list-style-type: none"> - Presentation - Discussions 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	30 minutes
5.6.8 Feeding technologies for doelings	<ul style="list-style-type: none"> - Presentation - Discussions 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop 	30 minutes
5.6.9 Feeding technologies for lactating does	<ul style="list-style-type: none"> - Presentation - Discussion 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	30 minutes
5.6.10 Feeding of bucks	<ul style="list-style-type: none"> - Presentation - Discussion 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop 	30 minutes

5.6.11 Module Review	- Individual exercise	- Review questionnaire	30 minutes
TOTAL			4 hours 30 minutes

5.7 Facilitator Guidelines

5.7.0 Feeding	
5.7.1. Introduction and Levelling Expectations (30 minutes)	Session Guide
<p>Introduction</p> <p>The facilitator welcomes trainees to the module dairy feeding management and introduces him/herself by stating his/her profile and experience of working with farmers.</p> <p><i>(The facilitator invites the trainees to state their expectation for the module).</i></p> <p>Module Objectives</p> <p><i>The facilitator presents modules objectives</i></p> <p>By the end of the module the trainees should be able to:</p> <ul style="list-style-type: none"> - Describe the guidelines for feeding dairy cattle and goats - Explain the early weaning diets for calves - Explain the use of alternative milk replacers in calf rearing - Describe the supplementation to improve performance of dairy cattle and goats - Explain the use of sweet potato vines as a milk replacer for kids 	<ul style="list-style-type: none"> • Summarize participants' "expectations" and display • PowerPoint presentation • Participants exercise • Participants flip chart presentations

5.7.2 Feeding of calves (30 minutes)	Session Guide
<p><i>The facilitator presents and discusses with trainees on the guidelines used in feeding calves.</i></p> <p>Presentation (20 minutes) on:</p> <ul style="list-style-type: none"> - Opportunities and challenges of feeding calves - Phases of calf feeding - Amounts of colostrum and milk fed to calves - Feeding of calves using artificial colostrum - Role of feeding roughage to stimulate rumen development - Feeding in relation to the growth rate of calves - The need for water in calf rearing <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss</p>	<ul style="list-style-type: none"> • Facilitator PowerPoint presentation • Participants exercise • Participants flip chart presentations
5.7.3 Early weaning of calves using milk replacers and protein-rich forages (30 minutes)	
<p><i>The facilitator presents on the use of milk replacers and protein-rich forages in the early weaning of calves.</i></p> <p>Presentation (20 minutes) on:</p> <ul style="list-style-type: none"> - Opportunities and challenges of feeding calves with milk replacers, protein-rich forages and concentrates - Definition of a milk replacer - Recommended chemical composition of the milk replacer - The compounding of an early weaning milk replacer (gruels) - Amounts of milk replacer fed to calves and their performance - Suitable protein-rich and concentrate supplements for calves - Amounts of protein-rich and concentrate supplements to be fed to calves and their performance <p>Discussion (10 minutes)</p> <p>After the presentation allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • Facilitator PowerPoint presentation • Participants exercise • Participants flip chart presentations

5.7.4 Feeding technologies for heifers (30 minutes)	
<p><i>The facilitator presents and discusses with trainees on the guidelines and technologies used for feeding heifers.</i></p> <p>Presentation (20 minutes) on:</p> <ul style="list-style-type: none"> - Opportunities and challenges of feeding heifers - Importance of feeding heifers on good quality rations - Recommended age/weight to the first service - Feeding to meet target growth rates - Suitable protein-rich forages and concentrates supplements for heifers - The need for minerals and water in heifer rearing <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • Facilitator PowerPoint presentation • Participants exercise • Participants flip chart presentations
5.7.5 Feeding technologies for lactating cows (30 minutes)	
<p><i>The facilitator presents and discusses with trainees on the guidelines and technologies used for feeding lactating cows.</i></p> <p>Presentation (30 minutes) on:</p> <ul style="list-style-type: none"> - Importance of feeding good quality rations to lactating cows - Role of minerals in relation to dam fertility and milk production - Steaming up of dams - Challenge feeding for milk production - Suitable protein-rich forages and concentrates supplements for lactating cows - Effect of diet on milk composition and flavour - Role of water in feeding lactating cows - Factors affecting milk production <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • Facilitator PowerPoint presentation • Participants exercise • Participants flip chart presentations

5.7.6 Feeding technologies for kids (30 minutes)	Session Guide
<p><i>The facilitator should be able to lead the trainees in understanding the guidelines and technologies for feeding kids.</i></p> <p>Presentation (20 minutes) on:</p> <ul style="list-style-type: none"> - Amount of milk for feeding kids - Use of sweet potato vines as a milk replacer for kids - Role of feeding roughage to stimulate rumen development - Age and weight of kids at weaning - The need for water in kids rearing <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • Facilitator PowerPoint presentation • Participants exercise • Participants flip chart presentations
5.7.7 Guidelines for feeding of doelings (30 minutes)	
<p><i>The facilitator presents and discusses with trainees on the guidelines for feeding doelings.</i></p> <p>Presentation (20 minutes) on:</p> <ul style="list-style-type: none"> - Recommended age/weight to the first service - Flushing of doelings - Steaming up of doelings - The need for minerals and water in doeling rearing <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • Facilitator PowerPoint presentation • Participants exercise • Participants flip chart presentations

5.7.8 Feeding technologies for lactating does (30 minutes)	
<p><i>The presenter presents and discusses with trainees on the guidelines and technologies used for feeding lactating does.</i></p> <p>Presentation (20 minutes)</p> <ul style="list-style-type: none"> - Importance of feeding good quality rations to lactating does - Use of protein-rich forages and concentrates supplements to improve performance of lactating does - Challenges in feeding lactating does for milk production - Unique qualities of goat milk - Role of water in feeding lactating does <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • Facilitator PowerPoint presentation • Participants exercise • Participants flip chart presentations
5.7.9 Feeding of breeding bucks (30 minutes)	
<p><i>The facilitator presents and discusses with trainees on guidelines used in feeding breeding bucks</i></p> <p>Presentation (20 minutes) on:</p> <ul style="list-style-type: none"> - Feeding of breeding bucks in preparation for mating - Suitable age of buck to be ready for breeding - Feeding of bucks during mating - The ratio of bucks:does <p>Discussion (10 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • Facilitator PowerPoint presentation • Participants exercise • Participants flip chart presentations

5.7.10 Module review (30 minutes)	
<p><i>(The facilitator should let the trainees to present their views on each of the sessions covered under this module. On flip chart list and summarize the key points they should emphasize when training farmers)</i></p> <p>Review the main points about dairy feeding by answering the following:</p> <ol style="list-style-type: none"> 1. <i>What new things did you learn from this topic?</i> 2. <i>What other important aspects/topics were omitted?</i> 3. <i>Any other comments</i> 	<p>Distribute handout and questionnaire on module review</p>

5.8 Participants' Handouts

1. Processing cassava root for dairy cattle feeding pamphlet
2. Rear your own heifers
3. Feed calves with nutritious gruel
4. Feed cassava leaves to dairy cattle in the dry season
5. Learn how to rear dairy goats
6. Rearing the milk goat

MODULE 6

MANURE MANAGEMENT FOR BIOENERGY AND SOIL FERTILITY IMPROVEMENT

6.1 Introduction to the Module

This module will address appropriate technologies in manure management for bioenergy and soil fertility improvement. It will deal with utilization of bio-slurry, farmyard and compost manure for forage production and slurry for production of domestic biogas. The learners will be introduced to manure management practices and different types of biogas-digesters which include the following; fixed domes, floating drum or tubular models. They will also be trained on anaerobic digestion processes which converts organic wastes into biogas (combustible mixture of methane and carbon dioxide) and high-quality fertilizer as well as a mitigation strategy for GHG emission.

6.2 Module Learning Outcomes

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

- a) Knowledge on use of manure for domestic bioenergy acquired and shared
- b) Knowledge on use of bio slurry from anaerobic digesters to improve soil fertility, soil structure and crop productivity acquired and shared
- c) Use of farmyard manure to improve soil fertility, soil structure and crop productivity described and understood
- d) Compost making and utilization for improving soil fertility, soil structure and crop productivity described and understood
- e) Importance of domestic biogas digesters in mitigating GHG emissions and reduction of biomass fuel consumption explained and appreciated
- f) Knowledge on handling, storage and application methods of bio-slurry, farmyard and compost manure acquired and shared
- g) Use of domestic biogas as a source of residential energy supply described and understood

6.3 Target Group and Categories

This module targets County extension staff, private service providers and lead farmers

6.4 Module Users

This module is intended for use by Master trainers in dairy value chain who are members of the Core Team of Trainers (CTT).

6.5 Module Duration

The module is estimated to take 11 hours 20 minutes.

6.6 Module Summary

MANURE MANAGEMENT FOR BIOENERGY AND SOIL FERTILITY IMPROVEMENT			
Sessions	Training Methods	Training Materials	Time
6.6.1 Introduction, objectives, expectations	<ul style="list-style-type: none"> - Personal introduction - Presentation - Plenary 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Handouts 	30 minutes
6.6.2 Use of manure for bioenergy and soil fertility improvement.	<ul style="list-style-type: none"> - Presentation - Discussions 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	30 minutes
6.6.3 Demonstration of bio digester installation technique and biogas production process	<ul style="list-style-type: none"> - Presentation - Discussion - Practical 	<ul style="list-style-type: none"> - Display of various biogas installation techniques - Practical session 	2 hours
6.6.4 Domestic biogas as a source of residential energy supply	<ul style="list-style-type: none"> - Presentation - Discussion - Participants' practical involvement, - (exercise) questions, comments and observations 	<ul style="list-style-type: none"> - Projector - Laptop - Flip charts - Participants handouts 	1 hour
6.6.5 Importance of domestic biogas digesters in mitigating GHG emissions and reduction of biomass fuel consumption	<ul style="list-style-type: none"> - Presentation - Demonstration by trainer - Discussions 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participant' Handouts 	1 hour

6.6.6 Methods of manure handling, management and storage technique for nutrient preservation	<ul style="list-style-type: none"> - Presentation - Discussion 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	1 hour
6.6.7 Use of bio slurry from anaerobic digesters to improve soil fertility, soil structure and crop productivity	<ul style="list-style-type: none"> - Presentation - Discussions 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	1 hour
6.6.8 Use of farm yard manure to improve soil fertility, soil structure and crop productivity	<ul style="list-style-type: none"> - Presentation - Discussions 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	1 hour
6.6.9 Compost making processes and use to improve soil fertility, soil structure and crop productivity	<ul style="list-style-type: none"> - Presentation - Discussion - Participants' questions and comments 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	1 hour
6.6.10 Methodologies of manure application- <ul style="list-style-type: none"> - Trench application - Surface application - Tumbukiza method 	<ul style="list-style-type: none"> - Presentation - Discussion - Participants' questions and comments - Practical Session 	Farm Implements	2 hours
6.6.11 Module Review	Individual exercise	Review questionnaire	20 minutes
TOTAL	11 hours 20 minutes		

6.7 Facilitator Guidelines

6.7.0 Manure Management for Bio energy and soil fertility improvement	
6.7.1. Introduction and Levelling Expectations (30 minutes)	Session Guide
<p>Introduction</p> <p>The facilitator welcomes trainees to the module manure management for bio energy and soil fertility improvement as a general introduction of the module as well as an introduction of the team handling the module.</p> <p><i>(The facilitator invites the trainees to state their expectation for the module).</i></p> <p>Module Objectives</p> <p>The facilitator presents modules objectives</p> <p>By the end of the module, trainees should be able to:</p> <ul style="list-style-type: none"> - Explain the use of manure for domestic bioenergy - Explain the use of bio slurry from anaerobic digesters to improve soil fertility, soil structure and crop productivity. - Describe the use of farmyard manure to improve soil fertility, soil structure and crop productivity. - Describe compost making and utilization for improving soil fertility, soil structure and crop productivity. - Explain the Importance of domestic biogas digesters in mitigating GHG emissions and reduction of biomass fuel consumption - Appreciate the use of domestic biogas as a source of residential energy supply - Describe handling, storage and application methods of bio-slurry, farmyard and compost manure 	<ul style="list-style-type: none"> • Summarize participants’ “expectations” and display.

6.7.2 Use of manure for bioenergy and soil fertility improvement (30 minutes)	
<p><i>The facilitator presents and discusses with trainees on the use of manure for domestic bioenergy.</i></p> <p>Presentation and discussion (30 min)</p> <ul style="list-style-type: none"> - Importance of manure as fertilizer and for bioenergy - Soil fertility status - Effects of poor and good management of manure - Types of manure - Factors affecting quality of manure <p>After the presentations allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
6.7.3 Demonstration of bio digester installation technique and biogas production process (2 hours)	
<p><i>The facilitator should demonstrate installation techniques of various bio-gas digesters</i></p> <p>Presentation and practical demonstrations (1 hours 30 minutes)</p> <ul style="list-style-type: none"> - Site identification - Safety precautions needed before, during and after the installation of bio-digester. - Discussion on biogas installation system - Different types of bio-digesters <ul style="list-style-type: none"> ○ Fixed domes ○ Floating drum ○ Tubular models - Pros and cons of various types of bio-gas digester designs - Cost of different type of digesters and list accredited technicians - Display of various biogas installation techniques <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Practical demonstration • Plenary discussion

6.7.4 Domestic biogas as a source of residential energy supply (1 hour)	
<p><i>The facilitator presents and leads participants in discussing the important of domestic biogas as a source of energy supply.</i></p> <p>Presentation</p> <ul style="list-style-type: none"> - Different sources of energy for domestic use - Pro and cons of other sources - Importance of biogas as source of residential energy - Uses of biogas and benefits - Energy demand and equations - Calorific values of different domestic fuels - Biogas production from different feed stocks - Distribution statistics of biogas systems in Kenya - Challenges limiting adoption of biogas in Kenya 	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
6.7.5 Importance of domestic biogas digesters in mitigating GHG emissions and reduction of biomass fuel consumption (1 hour)	
<p><i>The presents and guides participants in identifying sources of greenhouse gases and mitigation methods.</i></p> <p>Presentation and Practical (40 minutes)</p> <ul style="list-style-type: none"> - Livestock production as contributors of GHG emission <ul style="list-style-type: none"> ○ GHG emission pathways ○ Enteric digestions ○ Other sources of GHG emission (charcoal, firewood and fossil fuel) - Quantification of emissions - Mitigation strategies <ul style="list-style-type: none"> ○ Conversion of organic wastes into biogas (combustible mixture of methane and carbon dioxide) ○ Anaerobic digestion sources and as a mitigation tool for GHG emission <p>Discussion (20 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

6.7.6 Methods of manure handling, management and storage technique for nutrient preservation (1 hour)	
<p><i>The facilitator should demonstrate various methods of manure handling and storage techniques.</i></p> <p>Presentation (40 minutes)</p> <ul style="list-style-type: none"> - Different types of manure - Factors affecting quality of different types of manure - Nitrogen cycle - Nutrient composition of different types of manure. <p>Discussion (20 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss the topic</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
6.6.7 Use of bio slurry from anaerobic digesters to improve soil fertility, soil structure and crop productivity (1 hour)	
<p><i>The facilitator presents and guides participants in identifying potential use of bio slurry from anaerobic digesters to improve soil fertility, soil structure and crop productivity.</i></p> <p>Presentation (40 minutes)</p> <ul style="list-style-type: none"> - Bio slurry as fertilizer - Factors affecting nutrient composition of slurry manure: <ul style="list-style-type: none"> ○ Type and size of the animal ○ Type of feed given to the animal ○ The structures where animals are kept ○ The flow and harvesting of slurry - Nutrient composition of bio-slurry - Application methods and rates of bio-slurry on Napier grass <p>Discussion (20 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

6.7.8 Use of farm yard manure (FYM) to improve soil fertility, soil structure and crop productivity (1 hour)	
<p><i>The facilitator presents and guides trainees in identifying the use of farmyard manure to improve soil fertility, soil structure and crop productivity.</i></p> <p>Presentation (40 minutes)</p> <ul style="list-style-type: none"> - FYM as fertilizer - Factors affecting nutrient composition of farm yard manure: <ul style="list-style-type: none"> ○ Type and size of the animal ○ Type of feed given to the animal ○ The structures where animals are kept ○ The flow and harvesting of farm yard manure - Nutrient composition of farm yard manure - Application methods and rates of farm yard manure on Napier grass <p>Discussion (20 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
6.7.9 Compost making processes and utilization for soil fertility improvement. (1 hour)	
<p><i>The facilitator presents and guides trainees in identifying potential use of compost manure to improve soil fertility, soil structure and crop productivity.</i></p> <p>Presentation (40 minutes)</p> <ul style="list-style-type: none"> - Compost making demonstration - Compost manure as fertilizer - Factors affecting nutrient composition of compost manure <ul style="list-style-type: none"> ○ Type and size of the animal ○ Type of feed given to the animal ○ The structures where animals are kept ○ Composting process - Nutrient composition of compost manure - Application methods and rates per unit of land <p>Discussion (20 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

6.7.10 Methodologies of manure application (2 hours)	
<p><i>The facilitator guides trainees on the various application methods for different types of manure.</i></p> <p>Practical demonstrations (1 hour 30 minutes)</p> <p>Method of manure application:</p> <ul style="list-style-type: none"> ○ Trench ○ Surface ○ Tumbukiza <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> ● Practical demonstration ● Plenary discussion
6.7.11 Module Review (20 minutes)	
<p><i>(The facilitator should let the trainees present their views on each of the sessions covered under this module. On flip chart list and summarize the key points they should emphasize when training farmers)</i></p> <p>Review the main points about manure and bioenergy by answering the following:</p> <ol style="list-style-type: none"> 1. <i>What new things did you learn from this topic?</i> 2. <i>What other important aspects/topics were omitted?</i> 3. <i>Any other comments</i> 	<p>Distribute handouts and questionnaire for module review</p>

6.8 Participants' Handouts

1. Ayako, W. (2013). Manure management under smallholder dairy farmers' conditions in Kenya. 1st ed. Lambert academic publishers
2. Gichangi, E., Kathuli, P., Nguluu, S. and Wambua, J. (2010). Conservation of nutrients in animal manures. 1st ed. KALRO- Katumani-Kenya, pp.1-3
3. Lekasi, J.K., Tanner JC, Kimani S. K. Harris P.J. C. 2001. Managing manure to sustain smallholder livelihood in the East Africa highlands. HDRA publications
4. Murage, A. W., Ilatsia, E.D., Ayako, W.O., Cheruiyot, B. K., and Ole Pulei, R.N. 2012. Manure management under smallholder conditions: a training manual. First Edition. Kenya Agricultural Research Institute, Nairobi, Kenya
5. Murage, A. W., Ilatsia, E.D., Ayako, W.O., Cheruiyot, C. K. and Ole Pulei, R.N 2012. Manure management under smallholder condition: farmers' information leaflets. (EAAPP) Kenya Agricultural Research Institute, Nairobi, Kenya

MODULE 7

MILK VALUE ADDITION

7.1 Introduction to the Module

This training is aimed at equipping participants with adequate knowledge on clean milk production and value addition.



Milk processing training at Kaguru Farmers Training Centre, Meru County (L) and milk products at KALRO Ol Joro Orok (R)

7.2 Module Learning Outcomes

By the end of the module participants should be able to train farmers on:

- a) Information on legislations, regulations and standards for milk and milk products acquired and shared
- b) Knowledge on clean milk production and handling enhanced and shared
- c) Knowledge on milk value addition and good manufacturing practices acquired and shared
- d) Knowledge on practical milk processing technologies (fermented and non-fermented milk products) enhanced and shared.
- e) Knowledge on basic dairy enterprises records for increased profitability enhanced and shared

7.3 Target Group and Categories

This module targets county extension staff, private service providers and lead farmers

7.4 Module Users

This module is intended for use by Master trainers in dairy value chain who are members of the Core Team of Trainers (CTT).

7.5 Module Duration

The Module is estimated to take **10 hours 10 minutes**.

7.6 Module Summary

MILK VALUE ADDITION			
Sessions	Training Methods	Training Materials	Time
7.6.1 Introduction, objectives, expectations	<ul style="list-style-type: none"> - Personal introduction - Presentation - Plenary 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' Handouts 	20 minutes
7.6.2 Legislations, regulations and standards for milk and Milk Products	<ul style="list-style-type: none"> - Presentation - Discussions 	<ul style="list-style-type: none"> - Flip charts, felt pens - Projector - Laptop - KEBS Standards 	2 hours
7.6.3 Clean milk production and Milk handling	<ul style="list-style-type: none"> - Presentation - Discussion 	<ul style="list-style-type: none"> - Flip charts, felt pens - Projector - Laptop - Participants' Handouts 	1 hour
7.6.4 Good manufacturing practice	<ul style="list-style-type: none"> - Demonstration - Presentation - Discussion 	<ul style="list-style-type: none"> - Flip charts, felt pens - Projector - Laptop - Participants handouts 	1 hours 30 minutes
7.6.5 Milk processing	<ul style="list-style-type: none"> - Presentation - Discussion - Practical 	<ul style="list-style-type: none"> - Audio-visual clips - Projector - Laptop - Participants' handouts 	3 hours

7.6.6 Packaging, labelling and barcoding	- Demonstration by trainer - Discussions	- Projector - Laptop - Flip charts, felt pens	1 hour
7.6.7 Dairy business record keeping	- Discussions	- Projector - Laptop - Flip charts, felt pens	1 hour
7.6.8 Module Review	- Individual exercise	- Review questionnaire	20 minutes
TOTAL			10 hours 10 minutes

7.7 Facilitator Guidelines

MODULE 7.0: MILK VALUE ADDITION	
7.7.1 Introduction and Levelling Expectations (20 minutes)	Session Guide
<p>Introduction</p> <p><i>The facilitator welcomes trainees to the module milk value addition and introduces him/herself by stating his/her profile and experience of working with farmers.</i></p> <p><i>(The facilitator invites the trainees to state their expectation for the module).</i></p> <p>Module Objectives</p> <p><i>(The facilitator presents modules objectives)</i></p> <p>By the end of the module trainees should be able to:</p> <ul style="list-style-type: none"> • Explain legislation, regulations and standards for milk and milk products. • Describe clean milk production and milk handling • Describe milk value addition and good manufacturing practices • Explain theory and practical milk processing technologies (fermented and non-fermented milk products) • Explain the importance of packaging, methods and barcoding • Explain the basic dairy enterprises records for increased profitability 	<ul style="list-style-type: none"> • Summarise participants’ “expectations” and display. • PowerPoint presentation • Participants exercise • Participants flip chart presentations

7.7.2 Legislations, regulations and standards for milk and Milk Products (2 hour)	
<p><i>The facilitator presents and guides trainees; showing the essence of legislation, regulations and standards to register a product.</i></p> <p>PowerPoint presentation</p> <ul style="list-style-type: none"> • The role of the regulator- KEBS, KDB, Public health, County Government among others will be learnt • The regulatory standards and their content will be explained and availed to the participants • The participants will learn about the variety of milk products that they can register and the fees applicable • Basic regulatory requirements to operate a milk cottage industry and protocols <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Participants exercise • Participants flip chart presentations
7.7.3 Clean milk production and milk handling (1 hour)	
<p><i>The facilitator presents and discusses with trainees, explaining and showing the requirements and steps for clean milk production.</i></p> <p>PowerPoint presentation</p> <ul style="list-style-type: none"> • The requirements of hygienic milking • Steps in hygienic milking • Steps in cleaning equipment after milking • Milk handling <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Participants exercise • Participants flip chart presentations
7.7.4 Good manufacturing practice (1 hour 30 minutes)	
<p><i>The presents and discusses with trainees on good manufacturing practices in dairy processing.</i></p> <p>Presentation</p> <ul style="list-style-type: none"> • Methods, equipment, facilities and controls for producing processed milk products. <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issue and discuss</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion • Participants exercise • Participants flip chart presentations

7.7.5 Milk processing (3 hours)	
<p><i>The facilitator presents and explains to the trainees the different milk value added products and the steps of milk processing.</i></p> <p>PowerPoint presentation</p> <ul style="list-style-type: none"> • Quality verification tests of milk before processing • Ingredients and equipment necessary for value addition of various dairy products • Processing steps of various value-added products mainly UHT, yoghurt, mala/lala, cheese, butter and ghee and any others they may wish to learn • Setting up a cottage milk processing unit <p>Discussion (30 minutes)</p> <p>After the presentations allow trainees to raise any issues and discuss them.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
7.7.6 Packaging, labelling and barcoding (1 hours)	
<p><i>The facilitator guides trainees in demonstrating the packaging steps of different milk value added products.</i></p> <p>PowerPoint Presentation</p> <ul style="list-style-type: none"> • Packages for different products and their sources • Packaging equipment will be demonstrated • Labelling requirements in relation to regulatory provisions • Barcoding registration and barcode allocation requirements • Packing of finished value-added products viz UHT, yoghurt, mala/lala, cheese, butter and ghee • Proper storage of finished value-added products to minimize losses due to spoilage <p>Discussion (30 minutes)</p> <p><i>After the presentations allow trainees to raise any issues and discuss them.</i></p>	<ul style="list-style-type: none"> • PowerPoint presentation • Participants exercise • Practical demonstration

7.7.7 Dairy business record keeping (1 hour)	
<p><i>The facilitator presents and demonstrates to the training the different records necessary for a profitable dairy enterprise.</i></p> <p>PowerPoint Presentation</p> <ul style="list-style-type: none"> • Different types of records including production, sales, and other profitability records • Demonstrate different record entries • Records as decision making tools <p>Discussion (30 minutes)</p> <p><i>After the presentations allow trainees to raise any issues and discuss them.</i></p>	<ul style="list-style-type: none"> • Facilitator PowerPoint presentation • Participants exercise • Participants flip chart presentations
7.7.8 Module review (20 minutes)	
<p><i>(The facilitator should let the trainees present their views on each of the sessions covered under this module. On flip chart list and summarize the key points they should emphasize when training farmers)</i></p> <p>Review the main points in milk value addition by answering the following:</p> <ol style="list-style-type: none"> 1. <i>What new things did you learn from this topic?</i> 2. <i>What other important aspects/topics were omitted?</i> 3. <i>Any other comments</i> 	

7.8 Participants' Handouts

This is a short guide for dairy farmers to familiarize themselves with the range of publications and information on milk value addition

1. Adongo A. O., Miano D.M., Kariuki J. N., Kidake B. and Keya G.A. (2016). How to get fresh and hygienic milk from your cow. <http://www.kalro.org/asal-aprp>
2. KALRO Ol Joro Orok. Farmers' guide on milk value addition
3. MoAL&F. (2014). Ministry of Agriculture, Livestock and Fisheries. Dairy Cattle Extension Manual. 151 pages
4. Omondi S.P. (2008). How to avoid farm milk spoilage. KALRO information brochure 34/2008 (KALRO Muguga)
5. Otieno, K., Lanyasunya, T.P., Lokwaleput, I.K., Mutunga, T.K., Ondiek, J.O., Siamba, D.N., Msangi, B.S.J., Kibitok, N.K., Kassa, F., Ondoro, D.M., Maingi, P.M., Migwi, P.K. and Bwire, J.M.. (2013). Protect your milk and dairy products from pathogenic microbial contamination and save life. KALRO. East Africa Agric. Productivity Project

6. Yongo, D., Mwirigi, M., Nyongesa, D. and Makokha, S.N. (eds). (2014). *Training Guide for Trainers of Practitioners in the Dairy Value Chain*. Nairobi, Kenya

MODULE 8

DAIRY BUSINESS, COST BENEFIT ANALYSIS AND MARKETING

8.1 Introduction to the Module

The module is divided into two main topics 1) Dairy business and cost benefit analysis (2) Dairy marketing. The cost benefit analysis is important for efficient production and management of cows. It is used mainly as a decision-making tool to enable the trainers have an idea on how to assist the farmers determine whether the dairy production enterprise is making profits or losses. It is based on costs of materials, production system and the scale of production. Dairy marketing on the other hand focuses on competencies required to establish market linkages and develop a marketing plan. It further discusses the advantages of collective marketing approach and how to effectively market milk and milk products; formulate costing and pricing charts; marketing tools; project supply and demand curve in the market; advertise and promote dairy and dairy products; and maximize profit margin from dairy sales.

8.2 Module Learning Outcomes

By the end of the module participants should be able to train farmers on:

- a) Information on cost components in a dairy enterprise obtained and shared
- b) Information on sources of revenue in a dairy enterprise obtained and applied
- c) Knowledge on cost-benefit analysis under different production systems acquired and applied
- d) Knowledge on dairy farm accounting, financial records, computation of cash flows enhanced and shared
- e) Knowledge on milk marketing, marketing strategies, market functions and market planning enhanced and shared
- f) Knowledge on the types of milk markets, market channels, distribution networks, supply and demand patterns enhanced and shared
- g) Knowledge on the principles of marketing and 8 P's of marketing enhanced
- h) Information on advertising and promotion of milk and milk products obtained and shared

8.3 Module Target Group and Categories

This module County extension staff, private service providers and lead farmers

8.4 Module Users

This module is intended for use by Master trainers in dairy value chain who are members of the Core Team of Trainers (CTT).

8.5 Module Duration

The module is estimated to take **10 hours 40 minutes**

8.6 Module Summary

DAIRY BUSINESS, COST BENEFIT ANALYSIS AND MARKETING			
Sessions	Training Methods	Training Materials	Time
DAIRY BUSINESS AND COST BENEFIT ANALYSIS (6 hours 30 minutes)			
8.6.1 Introduction and Levelling Expectations	- Personal introductions - Plenary discussions	- Flip charts - Projector - Laptop - Participants handouts	20 minutes
8.6.2 Introducing dairy business	- Presentation - Discussion	- Projector - Laptop - Flip charts, felt pens	30 minutes
8.6.3 Identification of products sources of income in the enterprise	- Presentation - Group exercise	- Projector - Laptop - Flip chart - Participants handouts - Exercise guide	20 minutes
8.6.4 Identification of cost components in a dairy enterprise	- Presentation - Group exercise	- Projector - Laptop - Exercise guide	20 minutes
8.6.5 Cost benefit analysis and computations	- Presentation - Group exercise - Discussion	- Projector - Laptop - Exercise guide	2 hours 40 minutes

8.6.6 Financial records and cash-flows (Cash in/out flows and Net cash flow)	<ul style="list-style-type: none"> - Discussion - Presentation 	<ul style="list-style-type: none"> - Projector - Laptop - Flipchart, - Participants' handouts 	2 hours
DAIRY MARKETING (4 hours 30 minutes)			
8.6.7 Introduction to marketing	<ul style="list-style-type: none"> - Presentations - Plenary discussions 	<ul style="list-style-type: none"> - Flip charts - Projector - Laptop - Participants' handouts 	20 minutes
8.6.8 Types of milk markets, supply and demand patterns	<ul style="list-style-type: none"> - Presentations - Plenary discussions 	<ul style="list-style-type: none"> - Flips charts - Felt pens - Projector - Participants' handouts 	30 minutes
8.6.9 Marketing strategies, functions and market planning	<ul style="list-style-type: none"> - Presentations - Plenary discussions - Practical demonstrations 	<ul style="list-style-type: none"> - Flips charts - Felt pens - Projector - Participants' handouts 	40 minutes
8.6.10 Milk Market Channels, Value Chain and Distribution Networks	<ul style="list-style-type: none"> - Presentations - Plenary discussions - Practical demonstrations - Role playing 	<ul style="list-style-type: none"> - Flips charts - Felt Projector - Laptop - Participants handouts 	1 hour
8.6.11 Principles of marketing and the 8 Ps of marketing	<ul style="list-style-type: none"> - Presentations - Plenary discussions 	<ul style="list-style-type: none"> - Flips charts - Felt pens - Projector - Participants' handouts 	25 minutes
8.6.12 Product differentiation and promotion of milk and milk products / linking farmers to markets	<ul style="list-style-type: none"> - Presentations - Plenary discussions 	<ul style="list-style-type: none"> - Flips charts - Felt pens - Projector - Laptop - Participants handouts 	40 minutes

8.6.13 Business planning	<ul style="list-style-type: none"> - Presentations - Plenary discussions 	<ul style="list-style-type: none"> - Flips charts - Felt pens - Projector - Laptop - Handouts 	25 minutes
8.6.14 Module review	<ul style="list-style-type: none"> - Individual exercise 	<ul style="list-style-type: none"> - Review questionnaire 	30 minutes
Total Module duration		10 hours 40 minutes	

8.7 Facilitator Guidelines

8.7.0 Dairy Business, Cost Benefit Analysis and Marketing	
8.7.1. Introduction and Levelling Expectations (20 minutes)	Session Guide
<p>Introduction</p> <p>The facilitator welcomes trainees to the module on Dairy Business, Cost benefit analysis and Marketing and introduces themselves by stating their profile and experience of working with farmers.</p> <p><i>(The facilitator invites the trainees to state their expectation for the module).</i></p> <p>Module Objectives</p> <p><i>(The facilitator presents modules objectives)</i></p> <p>By the end of the module participants should be able to:</p> <ul style="list-style-type: none"> - Describe the cost components in a dairy enterprise - Describe the sources of revenue in a dairy enterprise - Explain the cost benefit analysis under different production systems - Explain the dairy farm accounting, financial records, computation of cash flows - Explain milk marketing, marketing strategies, market functions and market planning - Explain the types of milk markets, market channels, distribution networks, supply and demand patterns - Describe the principles of marketing and 8 P's of marketing - Explain advertising and promotion of milk and milk products 	<ul style="list-style-type: none"> • Summarise participants' "expectations" and display.

Dairy Business and cost benefit analysis	
1.61	8.7.2 Introducing dairy business (20 minutes)
<p><i>The facilitator presents and leads trainees in the discussion on cost and expenditure elements in a dairy enterprise</i></p> <p>Presentation</p> <ul style="list-style-type: none"> • Importance of dairy as a business <p>Discussion</p> <p>After the presentations allow participants to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
1.62	8.7.3 Identification of products and sources of income (30 minutes)
<p><i>The facilitator presents and leads trainees in discussing the products in a dairy enterprise</i></p> <p>Presentation</p> <ul style="list-style-type: none"> • Estimation of the quantity of milk produced and other dairy products • Estimation of the saleable cows (cull cow and heifers) • Sale of dairy products (milk, meat cows - culls, breeding cows) • Supplementary sources of income (manure, bulls, steers) <p>Discussion</p> <p>After the presentations allow trainees to raise any issue and discuss.</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion

8.7.4 Identification of cost components in a dairy enterprise (20 minutes)	
<p><i>The facilitator presents and discusses with trainees on the cost and expenditure elements in a dairy enterprise</i></p> <p>Presentation</p> <ul style="list-style-type: none"> • Determination of fixed cost components • Sample herd structure and the production system • Determine the expenditure avenues • Feeds requirements and costs using a sample herd structure • Workout various dairy costs <p>Discussion</p> <p>After the presentations allow participants to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
8.7.5 Dairy Cost Benefit Analysis (2 hours 40 minutes)	
<p><i>The facilitator leads trainees in carrying out cost benefit analysis in a dairy enterprise</i></p> <p>Practical computation using per unit cost analysis tool (30 minutes)</p> <p>Computation of:</p> <ul style="list-style-type: none"> • Variable costs • Fixed costs • Gross margins 	<ul style="list-style-type: none"> • PowerPoint presentation • Practical exercise • Plenary discussion
8.7.6 Financial Records (2 hours)	
<p>Presentation and practical exercise</p> <ul style="list-style-type: none"> • Importance of record keeping • Characteristics of good records • Other types of records in dairy farming <p>Discussion (30 minutes)</p> <p>After the presentations allow participants to raise any issues and discuss them</p>	<ul style="list-style-type: none"> • PowerPoint presentation • Practical exercise • Plenary discussion

8.7.7. Introduction to marketing (20 minutes)	
<p><i>(The facilitator presents on dairy marketing)</i></p> <p>Presentation</p> <ul style="list-style-type: none"> • Milk and milk products marketing • Marketing strategies to maximize on profit margins • Cluster formation in milk and milk products marketing • Enable the learner to adequately prepare marketing tools in the milk value chain • Costing and pricing of milk and milk products • Projecting dairy products supply and demand and set market targets • Advertising and promotion of milk and milk products 	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
8.7.8 Types of milk markets, supply and demand patterns (30 minutes)	Session guide
<p><i>(The facilitator to present on PowerPoint slides and flip charts on milk and milk products marketing)</i></p> <ul style="list-style-type: none"> - What is market and marketing - Supply and demand and how they affect prices - Milk costs, incomes, prices and profits 	<ul style="list-style-type: none"> • PowerPoint presentation • Plenary discussion
8.7.9 Marketing strategies, functions and marketing planning (40 minutes)	Session guide
<p><i>Present the following on PowerPoint slides and flip charts.</i></p> <p>Developing a marketing strategy involves three elements:</p> <ul style="list-style-type: none"> - Analyzing the present market situation - Formulating final marketing goals - Evaluating and selecting suitable marketing alternatives <p>Discussion (30 minutes)</p> <p>Trainees to consider all reasonable marketing alternatives. Consider the costs involved and other advantages and disadvantages of each alternative. Select a specific or a combination of marketing alternatives for discussion</p>	<ul style="list-style-type: none"> • Distribute participants' handouts • Marketing basics factsheet • PowerPoint presentation • Plenary discussion

8.7.10 Milk Market Channels, Value chain and Distribution Networks (1 hour)	Session guide
<p><i>Present the following on PowerPoint slides and flip charts:</i></p> <ul style="list-style-type: none"> - Different marketing channels and distribution networks - Choosing the right marketing channel as an essential tool to successful marketing - The price variations at each stage in accordance to value addition - Price margin; reflecting the percentage level of services provided at each stage through which the product passes, and the levels of demand and supply at different times of the year. - Market functions classified broadly into three groups: Exchange functions; Physical functions and Facilitating functions 	<ul style="list-style-type: none"> • PowerPoint Presentation • Distribute handouts to participants • Marketing basics Factsheet • Q& A session
8.7.11 Principles of marketing and 8 P of Marketing (25 minutes)	Session guide
<p>The facilitator presents and guides trainees on an easy way to organize a marketing plan covering: Product, Pricing, Place, Promotion, People, Process, Positioning and performance (8 Ps)</p>	<ul style="list-style-type: none"> • PowerPoint Presentation • Plenary discussion • Distribute handouts to participants on Dairy business
8.7.12 Product differentiation and promotion of milk and milk products / linking farmers to markets (40 minutes)	Session guide
<p>The facilitator guides trainees through presentation and discussion on the importance of having differentiated products and specialized niche markets for competitive advantage</p>	<ul style="list-style-type: none"> • PowerPoint Presentation • Plenary discussion • Q&A Session

8.7.13 Business planning (25 minutes)	Session guide
<p>The facilitator guides trainees on how to come up with a business plan and the major areas of focus in the document</p>	<ul style="list-style-type: none"> • PowerPoint Presentation • Plenary discussion • Q&A Session
8.7.14 Module review (30 minutes)	Session guide
<p><i>(The facilitator leads the trainees in reviewing the module)</i></p> <p>Review the main points of the module by answering the following:</p> <ol style="list-style-type: none"> 1. <i>What new things did you learn from this topic?</i> 2. <i>What other important aspects/topics were omitted?</i> 3. <i>Any other comments</i> 	<p>Distribute module evaluation questionnaire</p>

8.8 Participants' Handouts

1. CRS and MEAS. (2016). Seven steps of marketing: A SMART Skills manual. Catholic Relief Services (CRS), Baltimore, MD, and Modernizing Extension and Advisory Services (MEAS) project, University of Illinois at Urbana-Champaign
2. MoAL&F (2014). Ministry of Agriculture, Livestock and Fisheries. Dairy Cattle Extension Manual. 151 pages
3. Spears School of Business (2012). The nuts & bolts of great business plans, Oklahoma State University <http://entrepreneurship.okstate.edu>

MODULE 9

CROSS-CUTTING ISSUES

9.1 Introduction to the Module

This module introduces cross-cutting issues that affect the dairy value chain. These include gender, vulnerable and marginalized groups (VMG), social and environmental performance assessments as well as group dynamics and cohesion.

9.2. Module Learning Outcomes

By the end of the module participants should be able to train farmers on:

- a) Information on gender and VMG mainstreaming in dairy acquired and shared
- b) Knowledge on identification of indicators for conducting social and environmental performance in dairy operations enhanced and shared
- c) knowledge on group management , group dynamics and cohesion acquired and shared

9.3 Module Target Group and Categories

This module targets County extension staff, private service providers and lead farmers

9.4 Module Users

This module is intended for use by Master trainers in dairy value chain who are members of the Core Team of Trainers (CTT).

9.5 Module Duration

The module is estimated to take **7 hours**.

9.6 Module Summary

CROSS-CUTTING ISSUES			
Sessions	Training methods	Training materials	Time
9.6.1 Introduction, learning outcomes and expectations	<ul style="list-style-type: none"> - Personal introductions - Plenary discussions 	<ul style="list-style-type: none"> - Flips charts - Felt pens - Projector - Laptop 	30 minutes
9.6.2 Gender, Youth and VMG inclusion in dairy	<ul style="list-style-type: none"> - Presentations - Plenary discussions 	<ul style="list-style-type: none"> - Flips charts - Felt pens - Projector - Participants handouts 	1 hour 30 minutes
9.6.3 Socioeconomic impacts of dairy	<ul style="list-style-type: none"> - Presentations - Plenary discussions - Practical exercises 	<ul style="list-style-type: none"> - Flips charts - Projector - Laptop - Participants' handouts 	1 hour 30 minutes
9.6.4 Environmental impacts of dairy	<ul style="list-style-type: none"> - Presentations - Plenary discussions - Practical exercises 	<ul style="list-style-type: none"> - Flip charts - Felt pens - Projector - Participants handouts 	1 hour 30 minutes
9.6.5 Group dynamics and cohesion	<ul style="list-style-type: none"> - Presentations - Plenary discussions - Practical exercises 	<ul style="list-style-type: none"> - Projector - Participants Handouts 	1 hour 30 minutes
9.6.6 Model review	<ul style="list-style-type: none"> - Presentations - Plenary discussions 	Review questionnaire	30 minutes
Total duration			7 hours

9.7 Facilitator Guidelines

9.7.0 Cross-cutting Issues	
9.7.1 Introduction, objectives and expectations (30 minutes)	Session Guide
<p>Introduction (10 minutes)</p> <p>The facilitator welcomes trainees to the module and Invites the trainees to introduce themselves and state their expectations).</p> <p>Module Objectives (20 minutes)</p> <p><i>(The facilitator presents the module objectives)</i></p> <p>By the end of the module participants should be to:</p> <ul style="list-style-type: none"> - Explain gender and VMG mainstreaming in dairy - Describe identification of indicators for conducting social and environmental performance of dairy operations - Explain group management, group dynamics and cohesion 	<ul style="list-style-type: none"> • Summarize participants “expectations” and display
9.7.2 Gender, youth and VMG inclusion in dairy (1 hour 30 minutes)	Session guide
<p><i>(The facilitator to present on PowerPoint slides and flip charts</i></p> <ul style="list-style-type: none"> - Gender mainstreaming and inclusion <ul style="list-style-type: none"> ○ Youth empowerment in dairy value chain ○ Women empowerment in dairy value chain ○ Gender action planning - Strategies for inclusion of VMG in dairy value chain 	<ul style="list-style-type: none"> • PowerPoint Presentation • Plenary discussion • Distribute participants’ handouts on Gender

9.7.3 Socioeconomic impacts of dairy (1 hour 30 minutes)	Session guide
<p><i>Present (1 hour) the following on power point slides and flip charts:</i></p> <ul style="list-style-type: none"> - Roles of dairy in food and nutrition security - Social and economic impacts of dairy industry - Role of dairy in national economy - Role of dairy in poverty reduction and livelihoods <p>Discussion (30 minutes)</p> <p>Group discussions to determine the role of dairy in local economy and food security</p>	<ul style="list-style-type: none"> • PowerPoint Presentation • Plenary discussion • Distribute participants' handouts on socioeconomic impacts
9.7.4 Environmental impacts of dairy (1 hour 30 minutes)	Session guide
<p>The facilitator guides trainees through PowerPoint presentations and practical exercises on the following:</p> <ul style="list-style-type: none"> - Manure waste pollution control - Environmental risk assessment of dairy - Environmental impact assessment and audit of dairy farms 	<ul style="list-style-type: none"> • PowerPoint Presentation • Plenary discussion • Distribute participants' handouts on environmental impacts
9.7.5 Group dynamics and cohesion (1 hour 30 minutes)	Session guide
<p>The facilitator guides trainees on the following through presentation and discussion:</p> <ul style="list-style-type: none"> - Group leadership - Conflict resolution and behavior change - Role plays and cooperation - Social networks in dairy - Cultural roles and dynamics 	<ul style="list-style-type: none"> • PowerPoint Presentation • Plenary discussion • Distribute participants' handouts on group dynamics

9.7.6 Model review (30 minutes)	Session guide
<p><i>(The facilitator leads the trainees in reviewing the module)</i></p> <p>Summarize the main points of the training</p> <p>Review the main points on the module by answering the following:</p> <ol style="list-style-type: none"> 1. <i>What new things did you learn from this topic?</i> 2. <i>What other important aspects/topics were omitted?</i> 3. <i>Any other comments</i> 	<ul style="list-style-type: none"> - Distribute review questionnaire

9.8 Participants' Handouts

1. Jost, C., N. Ferdous, T. D. Spicer, 2014. Gender and Inclusion Toolbox: Participatory Research in Climate Change and Agriculture. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), CARE International and the World Agroforestry Centre (ICRAF). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org
2. Constitution of Kenya, 2010. Government of Kenya
3. Environmental Management and Coordination Act, 1999
4. FAO 2014. Gender in Food and Nutrition Security Programming. Conducting a gender analysis for programme design.
5. FAO. 2011. Dairy development in Kenya, by H. G. Muriuki, Rome, Italy
6. Ministry of Lands. National Land policy, May 2007
7. MoAL&F. 2014. Dairy Cattle Extension Manual. Ministry of Agriculture, Livestock and Fisheries. 151 pages
8. SNV 2018. Advocacy manual. Influencing Policies and Budgets to enhance Opportunities for Women Enterprises
9. The Environmental (Impact Assessment and Audit) Regulations, 2003
10. Thurston, A. 1987. Smallholder Agriculture in Colonial Kenya: The official mind and the Swynnerton Plan. Cambridge African Monographs No. 8
11. USAID. 2018. Enhancing investment attractiveness in Kenya's dairy sector. Feed the future program Policy Brief.
12. Waste Management Regulations, 2006
13. World Bank, Communication for Governance and Accountability Program. Theories of Behaviour Change

Annex 1: Programme for ToTs Dairy Value Chain TIMPs

Dates:

Cluster:

Venue:

Time	Day 0 (Sunday)	Duration	Remarks / Facilitator
Day 0: Sunday Late Evening	Travel to venue Arrival 1 Setting up and prepare training venue and materials		All The training venue and materials are ready for use
<i>Close of Day 0</i>			
Time	Day 1 (Monday)	Duration	Remarks / Facilitator
8.30 – 9.00 am	Registration		KALRO /CPCs KCSAP secretariat
	SESSION I: Session Chair:		Tobias Onyango

8.30-10.00 am	<p>Climate Setting</p> <p>Welcome by host and Prayers (Institute Director, DRI)</p> <ol style="list-style-type: none"> 1. Self-introductions –(CTT) 2. Training in-house matters and setting norms (CTT) 3. Official opening Ceremony (NPCU) 4. Introduction to the training program (Dairy VC Coordinator) 5. Formation of groups 	1 hour 30 minutes	The trainees relax and set climate for the 10-day training
The role of Dairy Sub-sector in Kenyan economy			
Module 1: Animal breeding and management			
10.00-10.30 am	<ol style="list-style-type: none"> 1.1.1 Dairy Animal Breeding and management: 1.1.2 Introduction to the Module 1.1.3. Objectives and expectations 1.1. 4. Discussions 	30 minutes	Ruth
10.30-11.00 am	Tea Break (Group Photo)	30 minutes	Health Break
11.00-1.00 pm	<ol style="list-style-type: none"> 1.1.5 Introduction to Animal breeding 1.1.6. Selection and Crossbreeding <p>Discussions (Questions and answers)</p>	2 hours	Ruth
1.00 -2.00 pm	Lunch Break	1 hour	

2.00 - 5.00 pm	1.1.7 Introduction to ART protocols 1.1.8 Selection of candidates for ES/AI and heat detection	2 hours	Nakeel
5.00 - 5.30 pm	Coffee Break	30 minutes	
Close of day 1			
Time	Day 2 (Tuesday)	Duration	Remarks / Facilitator
8.00 -9.00 am	1.1.9 Hormonal therapy for Estrus Synchronization for use of AI and the Bull/bucks	1 hour	Nakeel
9.00 -10.30 am	1.1.10 Monitoring of ES/AI candidates and pregnancy diagnosis	1 hour 30 minutes	Nakeel
10.30-11.00 am	Tea Break	30 minutes	Health Break
11.00 am – 12.00	1.1.11 Reproductive diseases and their risks to ES/AI/ Bull/Buck	1 hour	Nakeel
12.00 – 1.00 pm	1.1.12 Management of dairy goat and calves (Questions and Answers)	1 hour	Ruth
	1.1.13 Module review		
1.00 -2.00 pm	Lunch Break	1 hour	
Module 2: Animal Health			

2.00 – 3.00 pm	2.1.1 Climate Setting for the new topic Introduction to the module and leveling of expectations 2.1.2 Concept of health and disease in farm animals 2.1.3 Causes of disease and requirements for keeping animals healthy 2.1.4 Climate related diseases and pests/parasites in dairy cattle, goats and camels	1 hour	Mugambi/Mutisya
3.00 – 4.00 pm	2.1.5 Biosecurity 2.1.6 Mastitis and milk contaminants	1 hour	Mugambi/Mutisya
4.00 – 5.00 pm	2.1.7 Metabolic diseases 2.1.8 Poisoning 2.1.9 Safe and effective use of veterinary drugs, vaccines and pesticides 2.2.0 Integrated disease control & practical 2.2.1 Module review/feedback	1 hour	Mugambi/Mutisya
5.00 -5.30 pm		30 minutes	
Close of day 2			
Time	Day 3 (Wednesday)	Duration	Remarks / Facilitator
8.30 – 9.00 am	Introduction of facilitators General introduction of modules 3.0, 4.0, and 5.0 Participant expectations	30 minutes	Muia
Module 3: Feed Resources			

9.00 – 9.30 am	3.1.1 Module objectives	30 minutes	Ouko
9.30 – 10.00 am	3.1.2 Classification of feed resources 3.1.3 Forage ecological suitability, agronomic management, and biomass yield	30 minutes	Nguru
10.00 -10.30 am	Tea Break	30 minutes	
10.30 – 11.00 am	3.1.4 Factors affecting forage biomass yields and quality	30 minutes	Nguru
11.00 – 12.00 pm	3.1.5 Forage pests and diseases	1 hour	Nguru
12.00 – 1.00 pm	3.1.6 Crop residue	1 hour	Okitoi/ Kiura
1.00 – 2:00 pm	Lunch Break	30 minutes	
2.00 – 2.30 pm	3.1.7 Protein-rich forage and concentrate supplements	30 minutes	Kiura
2.30 – 3.00 pm	3.1.8 Anti-nutritive factors in dairy feeds	30 minutes	Kiura
3.00 – 4.00 pm	3.1.9 Forage conservation	1 hour	Nguru
4.00 – 4.30 pm	3.2.0 Dairy feeds quality and safety	30 minutes	Ouko
4.30 – 5.00 pm	3.2.1 Keeping of dairy feed records	30 minutes	Ouko
5.00 – 5.30 pm	Coffee Break	30 minutes	
Close of day 3			
Day 4 (Thursday)			
8.30 – 9.00 am	3.2.2 Budgeting of dairy feeds	30 minutes	Paul
9.00 – 10.00 am	3.2.3 Keeping of dairy feed records	1 hour	Ouko
	3.2.4 Module Review		
10.00-10.30 am	Tea Break	30 minutes	
Module 4: Feed formulation			
10.30 – 11.30 am	4.1.1 Module objectives 4.1.2 Nutrient requirements of dairy cattle and goats	1 hour	Muia

11.30 – 12.00 pm	4.1.3 Information required to formulate dairy feed rations	30 minutes	Muia
12.00 – 12.30 pm	4.1.4 Nutrient balanced dairy feed rations	30 minutes	Muia
12.30 – 1.00 pm	4.1.5 Guidelines on formulation of dairy feed rations	30 minutes	Muia
1.00 – 2.00 pm	Lunch Break	1 hour	
2.00 – 3.30 pm	4.1.6 Dairy feeds ration formulation methods	1 hour 30 minutes	Muia
3.30 – 5.00 pm	4.1.7 Exercise on formulation of Home-made concentrates (HMCs)	1 hour 30 minutes	Muia
5.00 – 5.30 pm	Coffee Break	30 minutes	
Close of day 4			
Day 5 (Friday)			
8.30 – 9.00 am	4.1.8 Exercise on formulation of total mixed rations (TMR)	30 minutes	Muia
9.00 – 9.30 am	4.1.9 Feed mill equipment, capacities and their costs.	30 minutes	Ouko
9.30 – 10.00 am	4.2.0 Practical mixing of HMCs	30 minutes	Ouko
10.00-10.30 am	Tea Break	30 minutes	
10.30 – 11.30 am	4.2.1 Practical mixing of TMRs	1 hour	Ouko
	4.2.2 Module Review		
Module 5: Feeding of dairy cattle and goats			
11.30 – 12.00 pm	5.1.1 Module objectives	30 minutes	Paul
	5.1.2 Guidelines for feeding calves		
12.00 -12.30 pm	5.1.3 Early weaning of calves using milk replacers and protein rich-forages	30 minutes	Paul
12.30 – 1.00 pm	5.1.4 Guidelines for feeding heifers	30 minutes	Paul
1.00 – 2.00 pm	Lunch Break	1 hour	

2.00 – 2.30 pm	5.1.6 Guidelines for feeding lactating cows	30 minutes	Paul
2.30 – 3.00 pm	5.1.7 Feeding dairy goat kids	30 minutes	Kiura
3.00 – 3.30 pm	5.1.8 Feeding of doelings	30 minutes	Kiura
3.30 – 4.00 pm	5.1.9 Feeding of lactating does	30 minutes	Kiura
4.00 – 5.00 pm	5.2.0 Feeding of breeding bucks	1 hour	Kiura
5.00 – 5.30 pm	5.2.1 Module Review	30 minutes	
Coffee Break			
Close of day 5			
Time	Day 6 (Monday)	Duration	Remarks / Facilitator
Module 6. Manure Management for Bioenergy			
8.00 - 8.30 am	Climate Setting for the new topic Welcome by host and Prayers 6.6.1. Introduction, objectives, expectations	30 minutes	Ayako
8.30 – 9.30 am	6.6.2 Use of manure for domestic bioenergy	1 hour	Serem
9.30 -10.30 am	6.6.3 Use of bio slurry from anaerobic digesters to improve soil fertility, soil structure and crop productivity	1 hour	Ayako
10.30 -11.00 am	Tea Break	30 minutes	
11.00 am – 12.00 pm	6.6.4 Importance of domestic biogas digesters in mitigating GHG emissions and reduction of biomass fuel consumption	1 hour	Serem
12.00 – 1.00 pm	6.6.5 Methodologies of manure application	1 1 hour	Ayako
1.00 - 2.00 pm	Lunch Break	1 hour	

2.00 - 4.00 pm	6.6.6 Domestic biogas as a source of residential energy supply	2 hours	Ayako
4.00 – 5.00 pm	6.6.7 Demonstration of bio digester installation techniques	1 hour	Serem
5.00 -5.30 pm	6.6.8 Module Review	30 minutes	
Close of day 6			
Time	Day 7 (Tuesday)	Duration	Remarks / Facilitator
8.00 - 8.30 am	Module 7 Milk Value Addition Climate Setting for the new topic Welcome by host and Prayers Self-introductions –(CTT) 7.6.1 Introduction, objectives	30 minutes	Winnie
8.30-9.30 am	7.6.2 Legislations, regulations and standards for milk and Milk Products	1 hour	Winnie
9.30-10.00 am	7.6.3 Clean milk production and Milk handling	30 minutes	Winnie
10.00 -10.30 am	Tea Break	30 minutes	Winnie
10.30-11.30 am	7.6.4 Good manufacturing practice	1 hour	Elizabeth
11.30-1.00 pm	7.6.5 Milk processing	1.5 hours	Elizabeth
1.00 -2.00 pm	Lunch Break	1 hour	

2.00-5.00 pm	7.6.6 Packaging, labelling and barcoding 7.6.7 Dairy business record keeping 7.6.8 Practical Demonstrations 7.6.9 Outcomes 7.7.0 Module Review	3 hours	Elizabeth
5.00 – 5.30 pm	Coffee Break	30 minutes	
Close of day 7			
Time	Day 8 (Wednesday)	Duration	Remarks / Facilitator
Module 8: Dairy Business, Cost Benefit Analysis and Marketing			
8.00 - 8.30 am	8.1.1 Introduction and Levelling Expectations 8.1.2 Introducing dairy business	30 minutes	Mathai
8.30 -9.00 am	<ul style="list-style-type: none"> 8.1.3 Identification of products produced at the farm and identification of sources of income in the enterprise 	30 minutes	Wachira
9.00 – 10.00 am	<ul style="list-style-type: none"> 8.1.4 Identification of cost components in a dairy enterprise 8.1.5 Introduction to Cost benefit analysis 	1 hour	Mathai
10.00 -10.30 am	Tea Break	30 minutes	

10.30 -1.00 pm	<ul style="list-style-type: none"> 8.1.5 Cost benefit analysis and computations 	<ul style="list-style-type: none"> 2 hours 30 minutes 	<ul style="list-style-type: none"> Mathai
1.00 - 2.00 pm	Lunch Break	1 hour	
2.00 – 5.00 pm	8.1.6 Financial Records Cash flows (Cash in/out flows and Net cash flow)	3 hours	Wachira
5.00 – 5.30 pm	Coffee Break	30 minutes	
Close of day 8			
Time	Day 9 (Thursday)	Duration	Remarks / Facilitator
8.2 Dairy Marketing			
8.00 -9.00 am	8.2.1 Introduction to dairy marketing	<ul style="list-style-type: none"> 1 hour 	<ul style="list-style-type: none"> Mathai
	8.2.2 Types of milk markets, supply and demand patterns		
	8.2.3 Milk Market Channels, Value Chain and Distribution Networks		
	8.2.4 Principles of marketing / 8 Ps of marketing		
	8.2.5 Product differentiation and promotion of milk and milk products; Linking farmers to markets		
	Module review	<ul style="list-style-type: none"> 30 minutes 	<ul style="list-style-type: none"> Mathai
9.00 -10.00 am	8.2.5 Marketing strategies, functions and market planning	<ul style="list-style-type: none"> 1 hour 	<ul style="list-style-type: none"> Wachira
	8.2.6 Business planning		
1.00 - 2.00 pm	Lunch Break	1 hour	

Module 9: Cross-cutting Issues			
2.00 -2.30 pm	Climate Setting for the new topic	30 minutes	Mbugua
2.30 -5.00 pm	Welcome by host and prayers Introduction to the training program (CTT) Formation of groups and setting norms (CTT)	2 hours	Mbugua
5.00 – 5.30 pm	10.1.1 Introduction, learning outcomes and expectations 10.1.2 Gender, Youth and VMG inclusion in dairy Coffee Break	30 minutes	
Close of day 9			
Time	Day 10 (Friday)	Duration	Remarks / Facilitator
8.00 - 10.00 am	10.1.3 Socioeconomic impacts of dairy	1 hour	K'Oloo
10.00 -10.30 am	Tea Break	30 minutes	
10.30 -12.00 am	10.1.4 Environmental impacts of dairy	1 hour 30 minutes	Mbugua
12.00 - 1.00 pm	10.1.5 Group dynamics and cohesion	1 hour	Mbugua
1.00 - 2.00 pm	Lunch Break	1 hour	
2.00 – 4.00 pm	10.1.6 Group dynamics and cohesion 10.1.7 Module review	2 hours	Mbugua
4.00 – 4.30 pm	10.1.8 Training Evaluation	30 minutes	All
4.30 – 5.00 pm	10.1.9 Logistics and announcements		
4.20 – 4.50 pm	Coffee Break	30 minutes	
Departure			





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