Sustainable Agricultural Livelihood Restoration, Rehabilitation and Resilience in Kenya

Users' Guide for Trainers'

EMERGENCY LOCUST RESPONSE PROJECT (ELRP)

SEPTEMBER, 2022

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Disclaimer

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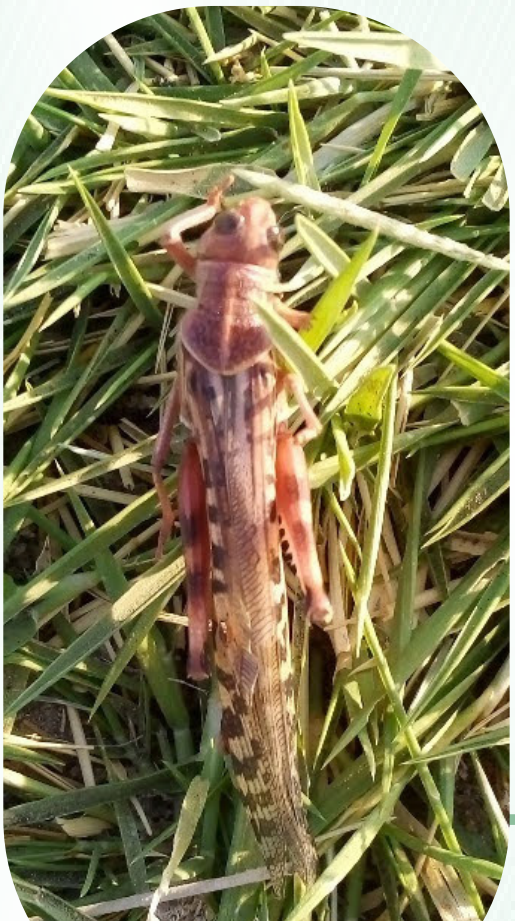

ABBREVIATIONS & ACRONYMS

ASAL	Arid and Semi-Arid Lands
CA	Conservation Agriculture
CC	Climate Change
CV	Climate variability
CSA	Climate Smart Agriculture
DL	Desert Locust
ELRP	Emergency Locust Response Project
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
IPM	Integrated Pest Management
KALRO	Kenya Agricultural and Livestock Research Organisation
KMS	Kenya Meteorological Service
NCEP	National centre for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NGO	Non-Governmental Organisation
NRM	Natural Resource Management
RADAR	Radio Detection and Ranging
SWC	Soil and Water Conservation
TIMPs	Technologies Innovations and Management Practices
VMG	Vulnerable and Marginalised Group
WMO	World Meteorological Organisation

Foreword

The Emergency Locust Response Project (ELRP), is a four-year (2020/2021 to 2023/2024) project initiated by the Government of Kenya and supported by the World Bank. The aim of the project is to prevent and respond to the threat to livelihoods posed by the Desert Locust outbreak and to strengthen Kenya's systems for preparedness. Component two of the project is on livelihood restoration and protection. It is being implemented in 15 counties that were adversely affected by the Desert Locust invasion. The component is designed to support livelihood restoration and protection interventions among the affected and vulnerable communities through training and capacity building on best practices on relevant Agricultural Technologies, Innovations and Management Practices (TIMPs).

In this regard, training guide is essential for ensuring effective, efficient and systematic delivery of best practices on relevant Agricultural TIMPs to the affected and vulnerable communities. The guidelines are designed to promote best practices in the design, implementation and evaluation of response and impacts on the livelihood and food security shocks arising from natural disasters.

The guidelines represent a synthesis of experience from practitioners working in government agencies, non-governmental organizations (NGOs) and National Research Systems (NARS) i.e. research institutions in Kenya, plus lessons learned from other countries in the region. The information was collated by Working Groups under the Emergency Locust Response Programme (ELRP), in collaboration with stakeholders and professional consultations. The guideline presents best practice as it is currently known in Kenya, and will be subject to review and refinement over time

I take this opportunity to thank the Cabinet Secretary, Ministry of Agriculture, Livestock, Fisheries and cooperatives, Hon. Peter Munya, the Principal Secretaries, State Departments of Crop Development and Agricultural Research and Livestock for their leadership and guidance in the project Implementation, and the World Bank for their financial and technical support.

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Mr. Collins M. Marangu

Director, Plant Protection and Food Safety Directorate (PPFSD)

Preface

Climate change induced disasters including droughts, floods, pests and diseases have posed challenges on food and nutrition security in Kenya. Desert Locust invasion is one of the recent disasters that occurred in Kenya ravaging crops and pastures in many parts of the Country mainly in the ASALs. The situation was exacerbated by drought that affected most of the pastoral communities in Kenya, disrupting sources of livelihoods and more so livestock production. This necessitated designing and supporting implementation of livelihood restoration and rehabilitation interventions geared towards enhancing community resilience for any future shocks. The National Coordination Unit (NCU) of the Emergency Locust Response Program (ELRP), in consultation with relevant experts drawn from various institutions, have developed these Guidelines. The institutions involved included the State Department for Crop Development and Agricultural Research, the State Department for Livestock Production, the Kenya School of Agriculture and the Kenya Agricultural and Livestock Research Organization (KALRO). The Guidelines are to be used in designing and implementing livelihood restoration and rehabilitation interventions among communities adversely affected by climate change and variability induced disasters. The major disasters being focused include pests and diseases outbreaks, droughts and floods. Application of the Guidelines is expected to ensure that communities are safeguarded and protected from loss of human, social and asset capital resulting from adverse effects of the natural calamities. Towards this end, capacity building of the affected and vulnerable communities has been identified as a key vehicle towards enhancing their resilience.

The objective of these guidelines is therefore to guide the MDAs and other development partners involved in training and capacity building of communities in livelihood restoration and protection in delivery of best practices on relevant Agricultural Technologies, Innovations and Management Practices (TIMPs). Furthermore, the Guidelines acknowledge that there are several enablers to designing and implementing sustainable livelihood restoration and protection interventions. These include Information and communication technology (ICT) innovations; Agribusiness; Social inclusion, Gender mainstreaming, Leadership and Governance. These have been incorporated in the Guidelines. Appropriate training methodologies and approaches, training materials and relevant references have been provided under each module to further facilitate learning and knowledge acquisition.

Esther Wambua

National Project Coordinator


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Background

Kenya has experienced several climate change induced disasters including emergence of pests and diseases, drought and floods among others. These disasters have posed challenges on food and nutrition security in the country with adverse effects on livelihoods. The Desert Locust (DL) upsurge experienced in Kenya between 2019 and 2021 was the worst in 70 years and affected the country's northern region posing a severe food security threat to about 3 million people. The situation was further exacerbated by drought that affected most of the pastoral counties in Kenya causing more damage to livelihoods among the affected communities.

Kenya has witnessed strong economic growth and declining poverty incidence, but absolute poverty remains high. Kenya's economy has experienced robust GDP growth averaging 5.8%, since 2011, catapulting Kenya to a middle-income country and significantly bringing down poverty levels. Kenya's poverty rate is among the lowest in East African countries, falling from 43.7% in 2005/06 to 36.8% in 2015/16 and 33.4% in 2019, with respect to the international poverty line.

The COVID-19 pandemic reversed some of the gains in poverty reduction, precipitating Kenya's first recession in 20 years and pushing an estimated two million Kenyans into poverty in 2020. Kenya's real GDP, which was growing at an annual pace of above 5%, contracted by 0.3% in the face of the triple shock of the pandemic comprising of the health impact, the economic impact of the containment measures, and behaviour changes, coupled with reverberations from a synchronised global recession. Kenya's economic outlook remains uncertain, and the projected return to above 5% growth rate faces several potential adverse scenarios, including slower than anticipated vaccination rollout, fiscal slippages, adverse weather conditions, and a weaker global economic backdrop. Policymakers face the challenge of supporting the recovery and laying the foundation for green, resilient, and inclusive development while reducing macro-financial vulnerabilities.

The greatest impact of Desert Locust invasion and drought was felt by households that depend on livestock and cropping activities and who are already facing acute food insecurity due to their existing high vulnerability and the effects of expected fodder and crop losses. For these households, locust impacts and drought led to deterioration in food security and a rise in food prices.

The Emergency Locust Response Program (ELRP) was thereafter conceptualised to supplement government resources against continued locust invasions. The Government accessed a World Bank credit of US$43 million (IDA 66480) to support a holistic response to the upsurge, including: swarm surveillance and control, livelihood restoration, and improving national preparedness against future outbreaks of locusts and other transboundary pests. The project has four components; component 1: Surveillance and Control Measures; Component 2: Livelihoods Protection and Rehabilitation and Component 3: Coordination and Early Warning Preparedness and Component 4: Project Management.

These guidelines are developed to facilitate capacity building and training of staff and lead farmers for implementation of livelihood restoration and rehabilitation interventions, to safeguard and protect the poor and vulnerable households from human, social capital and asset losses resulting from the effects of locust invasion, drought and other negative shocks affecting crops and livestock production. The affected farmers and livestock-holding households will be provided with Technologies, Innovations and Management Practices (TIMPs)/input packets and livelihood options to restore their productive assets; enhanced access to food and increased incomes.

ABOUT THE GUIDELINES

These guidelines are designed to promote best practices in the design, implementation and evaluation of agricultural interventions in response to livelihood and food security shocks and natural disasters, affecting pastoral and agro pastoral areas of Kenya.

The guidelines represent a synthesis of experience from practitioners working in government agencies, non-governmental organisations (NGOs) and National Research Systems (NARS) i.e. research institutions in Kenya, plus lessons learned from other countries in the region. The information was collated by Working Groups under the Emergency Locust Response Programme (ELRP), in collaboration with stakeholders and professional consultations. The guideline presents best practice as it is currently known in Kenya, and will be subject to review and refinement over time

The guidelines are organised into four sections namely: (i) Livelihood analysis (ii) Livelihood restoration and rehabilitation (iii) alternative livelihoods and (iv) Enablers that facilitate the attainment of the livelihood interventions.

INTENDED USERS OF THE GUIDELINES

The guidelines are intended for use by:

- Managers and technical staff working for National and County Governments and Government Agencies who are involved in designing and implementation of emergency response interventions.
- Community facilitators within Faith and Community based organisations and NGOs
- Relevant donor agencies.
- Universities and tertiary institutions teaching and undertaking research on relevant subjects.
- Private sector practitioners and extension service providers.

Training Methodology

- Lectures
- PowerPoint presentations
- Group work
- Demonstrations and practical sessions
- Field exercise
- Videos and Pictorial aids
- Case studies
- Simulations and role plays

SECTION ONE: LIVELIHOODS ANALYSIS

Introduction

Livelihoods analysis aims at understanding how people source, develop and use assets within a complex set of trends, shocks, and formal and informal policies and institutional arrangements. Such analysis is commonly based on a livelihood framework which categorises assets in terms of five main types of capital.

Human capital: This represents the skills, knowledge, labour capacity and good health that together, enable people to pursue different ways of making a living. In pastoralist areas, formal education and health services are often poorly developed and geographically distributed. Pastoralists however possess rich indigenous knowledge on livestock health and production.

Social capital: This is the social resources which people use to pursue different ways of making a living. Social capital includes networks, group membership, relationships of trust, and access to the wider institutions of society. The concept of reciprocity is important, as are the exchanges which facilitate co-operation. Pastoralists often have strong social capital at community level, with complex systems of indigenous social support based on the exchange of livestock.

Financial capital: This is the financial resources which people use to achieve livelihood objectives. It relates to both production and consumption, and the availability of cash (or equivalent) which enables conversion to other types of capital.

Natural capital: This is the natural environmental resources which people use to make a living. It includes soil, water, vegetation and wildlife resources, and encompasses access rights and land ownership. In general, pastoralist areas are characterised by low rainfall with high spatial variability. It is this rainfall pattern which largely determines the seasonal movement of pastoral herds (transhumance), and the seasonal variations in production and markets.

Physical capital: This is the basic infrastructure and producer goods needed to support livelihoods. In pastoralist areas, the physical capital required to support livestock production is often poorly developed. This includes roads, communication infrastructure and livestock markets.

Access to and use of these different types of capital is determined by various factors:

Seasonality

Particularly seasonal variations in rainfall, may result in favourable or demeaned livestock production causing glut or scarcity can affect resources realised impacting on and the terms of trade for livestock and livestock products and inputs required to support production.

Trends

Such as global climatic trends, the increasing occurrence and severity of drought, the growth of export markets for livestock, environmental change associated with increased GHG emmissions , private enclosure of rangeland, and human population growth can have negative impacts on livelihoods.

Shocks

Such as livestock disease epidemics and conflicts are becoming increasingly common; and as drought becomes more regular and predictable it might be categorised as a seasonal factor rather than a shock and planning for its mitigation will become inevitable.

Livelihood Strategies

Livelihood strategies determine how people access and use these assets, within the aforementioned social, economic, political and environmental contexts. The range and diversity of livelihood strategies are enormous. An individual may take on several activities to meet his/her needs. One or many individuals may engage in activities that contribute to a collective livelihood strategy. Within households, individuals often take on different responsibilities to enable the sustenance and growth of the family. In some cultures, this grouping may expand to a small community, in which individuals work together to meet the needs of the entire group.

Livelihood Vulnerability

The strength of a given livelihood is not only measured by its productive outcomes, but equally by its resilience to shocks, seasonal changes and trends. Shocks might include natural disasters, wars, and economic downturns. Availability of resources, income-generating opportunities, and demand for certain products and services may fluctuate seasonally. More gradual and often predictable, trends in politics and governance, technology use, economics, and availability of natural resources, can pose serious obstacles to the future of many livelihoods. These changes impact the availability of assets and the opportunities to transform those assets into a “living”. Under such conditions, people must adapt existing strategies or develop new strategies in order to survive.

Livelihood Interdependence

One final important characteristic of livelihoods is their interdependence. Very few livelihoods exist in isolation. A given livelihood may rely on other livelihoods to access and exchange assets. Traders rely on farmers to produce goods, processors to prepare them, and consumers to buy them. Livelihoods also compete with each other for access to assets and markets. Thus, positive and negative impacts on any given livelihood will, in turn, impact others. This is particularly an important consideration when planning livelihood interventions.

Livelihood Mapping

The livelihood mapping divides the country into areas where the rural population shares relatively homogeneous living conditions. The livelihood zone areas describe the agro-ecological and the socio-economic characteristics of the rural population, including the main livelihoods, the natural resources available, the potential constraints and priorities for development. The livelihood map is used to identify priority areas for investment according to the demand of the population. Livelihood mapping is therefore about gaining an accurate and realistic understanding of

people's strengths (assets or capital endowments) and how they endeavour to convert these into positive livelihood outcomes. It mainly considers: farm typology, livelihood zones and potential beneficiaries.

a) Farm typology:

This is basically the integration of two or more components of agricultural production system to maximise the profitability in per unit area of a land and to minimise risk.

b) Livelihood zones:

A livelihood zone is an area within which people share broadly the same pattern of livelihood, including options for obtaining food and income and market opportunities. A livelihood zoning is essential for the following reasons as it provides:

1. geographic orientation of livelihood systems to inform food security analysis and assistance targeting
2. the basis for identifying geographically relevant food security monitoring indicators
3. a sampling frame for future on-the-ground assessments

Livelihood patterns clearly vary from one geographic area to another, which is why the preparation of a Livelihood Zone Map is a logical first step for livelihoods-based analysis.

c) Potential Beneficiaries:

Are persons who may be eligible to receive the benefits of an intervention Program benefits but may not necessarily the applicant for said benefits. In the ELRP are those people that benefited with the training and other activities undertaken to cope with the destruction caused by the desert locust invasion.

Livelihood Framework

There is no one-size-fits-all approach to livelihood interventions which are better adapted to the local context. Different factors fundamentally change the way livelihood interventions should be designed. This guide provides a livelihood assessment framework to guide trainers in determining the right combination of interventions to arrive at comprehensive options that are well adapted to the local context. The following are the sub modules for livelihood diversification.

SECTION TWO: LIVELIHOOD RESTORATION AND REHABILITATION INTERVENTIONS

Introduction

Livelihood restoration and rehabilitation interventions aim at safeguarding and protecting poor and vulnerable households from human capital and asset losses resulting from the effects of locust invasion, drought and other natural disasters emanating from climate change and variability. This will be achieved by supporting initiatives that enhance access to food and to rehabilitate food production systems and livelihoods. The households affected by the natural disasters should be supported to restore their productive assets, and to enhance adaptation and build resilience for climate change (CC). Farmers will be trained on livelihood restoration and rehabilitation interventions, suitable livelihood options; climate change and variability (CV), climate smart agriculture (CSA); conservation agriculture (CA); range management; natural resource management (NRM) and appropriate crops and livestock production Technologies, Innovations and Management Practices (TIMPs). These will be covered under climate change and variability, natural resource management, range rehabilitation, crop and livestock production, alternative livelihoods and the relevant enablers.

MODULE 1
CLIMATE CHANGE AND VARIABILITY

Introduction

Climate change and variability are a major threat to the agricultural sector globally. It is widely accepted that the changes in temperature, rainfall patterns, sea water level and concentration of carbon dioxide (CO_2) in the atmosphere is having the most devastating impacts on agricultural production. Crop production and food security in Kenya is under threat due to climate change and variability. Yet, agriculture is the mainstay of the Kenyan economy, contributing to food security and employment of rural households. Climate variability and change have adversely affected this sector and the situation is expected to worsen in the future. It is evident that the country is already experiencing episodes of climate change, manifested by seasonal changes in precipitation and temperature of varying severity and duration despite overreliance on rain-fed agriculture. This module covers five sub-modules as follows:

List of Sub-Modules

1. Elements of weather and climate- key terminologies
2. Climate Information Services
3. Climate-smart Agriculture
4. Conservation Agriculture
5. Gender in climate-smart and conservation Agriculture

SUB-MODULE 1 : ELEMENTS OF WEATHER AND CLIMATE- KEY TERMINOLOGIES

Introduction

A climate system consists of various components and dynamics. It comprises; atmosphere, ocean, ice and snow cover, land surface and its features. Mutual interactions between these components are physical, chemical and biological processes. All these processes are explained by a complex set of equations that predict their future under modelling and downscaling. Weather is what we see/hear/feel every day in a given location, which is the state of atmospheric conditions at a particular place and time. They are caused by both natural processes and human activities. While climate refers to average weather conditions (taken over a period not less than 30 years), including statistical description of its variations. The elements of weather and climate include: rain, humidity, wind, sunshine, cloudiness and temperature. They also include extreme events such as tornadoes, droughts and tropical cyclones.

Learning Objectives

By the end of this sub-module, the trainees will be able to:

1. Understand what a climate system is all about
   - Weather
   - Climate
   - Climate Change
   - Climate Variability
   - Greenhouse effect
   - Adaptation
   - Adaptive capacity
   - Carbon sink
   - Resilience
2. Understand how climate change and variability affect agriculture
   - Climate information services
   - Impacts of climate change and climate variability
   - Climate smart agriculture
   - Conservation agriculture

- Gender in climate-smart agriculture and conservation agriculture

Key Points

- Weather is the state of atmospheric conditions at a particular place and time
- Climate refers to average weather conditions (taken over a period not less than 30 years)
- Climate change (CC) is the change in the long-term meteorological average
- mate variability (CV) refers to year to year fluctuations including seasonal variations in the climate parameters.
- Causes of CC & CV are directly or indirectly caused by both natural processes and human activities.
- CliThese processes can increase accumulation of greenhouse gases (GHGs) in the atmosphere.
- Climate information services are important for planning and development.
- Gender issues are critical in CSA and CA activities.

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SUB-MODULE 2: CLIMATE INFORMATION SERVICES

Introduction

Information (data, knowledge) about past, present and future climate conditions. It is about the interest in understanding the implications of this information on development, people's livelihoods and the environment. It provides information relevant for designing and mainstreaming adaptation measures. It helps in adaptation planning for short, mid or long-term. Climate information facilitates early warning systems. Climate information is of three types: 1). Real time meteorological data - describes present weather; (2). Historical meteorological data - describes historical climates and (3). Future weather/climate short/medium range weather forecast, and long range climate predictions. There are four main scales of climate information (CI): (i). Global; (ii). Regional climates (iii). Microclimate (local scales) and (iv) Small-scale climates. The sources of CI are Weather stations (KMS, WMO, NOAA….); Satellite data (Instruments such as RADAR, Infrared…..); Re-analyse data – Use of climate models (NCEP, NCEP2, ERA Interim……). The data from these sources are processed and interpreted for decision making activities such as adaptation planning.

Learning Objectives

By the end of this sub-module, the trainees will be able to:

1. understand what is climate information
2. understand the importance of climate information in building agricultural resilience
3. support peer to peer learning among farmers practising Climate Resilient Sustainable Agriculture

Key Points

- Information (data, knowledge) about past, present and future climate conditions
- The data are processed and interpreted for decision making on CC and CV planning
- Provides information relevant for designing and mainstreaming adaptation measures
- Climate information facilitates early warning systems
- Impacts of CC & CV (and related adaptation measures) can be obtained from climate information (i.e. scenarios of the future climate)
- Climate Information contributes to resilience
- Climate services contribute to CSA and CA

Reference Materials

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SUB-MODULE 3: CLIMATE-SMART AGRICULTURE

Introduction

Climate-smart agriculture (CSA) is an integrated approach to managing landscapes—cropland, livestock, forests and fisheries--that address the interlinked challenges of food security and climate change. According to FAO, CSA is an approach that helps guide actions to transform agri- food systems towards green and climate resilient practices. CSA supports reaching internationally agreed goals such as the sustainable development goals (SDGs) and the Paris Agreement. It aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible. Examples of specific CSA interventions include soil management, drought-tolerant crop varieties, dairy development, farming catfish intensively, and carbon finance to restore crop fields, waste-reducing rice thresher, rainfall forecasts and incentive system for low-carbon agriculture. There are three pillars of CSA: food security, mitigation and adaptation. These are not meaningful if innovations are not adopted – whatever the reason for their neglect might be.

Learning Objectives

By the end of this sub-module, the trainees will be able to:

1. introduce extension providers and other stakeholders to Climate-smart Agriculture (CSA) farming systems
2. introduce extension providers and other stakeholders to CSA principles of sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing GHG emissions, where possible
3. enhance capacity of farmers to adopt CSA principles and practices for various crops production

Key Points

- Climate-smart agriculture is not a new agricultural system nor a set of practices
- It is a new approach, a way to guide the needed changes of agricultural systems given the necessity to jointly address food security and climate change
- CSA is not only about practices but also about policies, institutions and finances necessary to enable those changes
- Addresses multiple challenges faced by agricultural and food systems simultaneously and holistically
- It emphasises, sustainable productivity, adapting and building resilience to climate change and reducing and/or removing greenhouse gas emissions, where possible
- It is context specific

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SUB-MODULE 4: CONSERVATION AGRICULTURE

Introduction

Conservation Agriculture (CA) is a farming system that can prevent losses of arable land while regenerating degraded lands. It promotes maintenance of a permanent soil cover, minimum soil disturbance, and diversification of plant species. CA is a method of farming that conserves, improves and uses natural resources more efficiently through sustainable intensification (integration) of locally available resources. It is a type of farming to achieve sustainable agriculture and improve livelihoods. It can be referred to as a resource efficient agricultural system**. In nutshell, CA** is a farming system that promotes minimum soil disturbance (i.e. no tillage), maintenance of a permanent soil cover, and diversification of plant species. It enhances biodiversity and natural biological processes above and below the ground surface, which contribute to increased water and nutrient use efficiency and to improved and sustained crop production. An example of CA can be seen in-production schemes (used for a smaller scale, but more intensively farmed land) focus on the sustainable management of arable crops or grassland, such as reduction of pesticides, reduction of grassland mowing, and most commonly, organic farming.

Learning Objectives

By the end of this sub-module, the trainees will be able to:

1. Introduce extension providers and other stakeholders to Conservation Agriculture (CA) farming systems
2. Enhance capacity of farmers to adopt CA principles and practices for various crops production

Key Points

- Weather is the state of atmospheric conditions at a particular place and time
- Climate refers to average weather conditions (taken over a period not less than 30 years
- Climate change is the change in the long-term meteorological average

- Climate variability refers to year to year fluctuations including seasonal variations in the climate parameters.
- Causes of CC & CV are directly or indirectly by both natural processes and human activities.
- These processes can increase accumulation of greenhouse gases (GHGs) in the atmosphere.
- Climate information services are important for planning and development.
- Gender issues are critical in CSA and CA activities.

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SUB-MODULE 5: GENDER IN CLIMATE-SMART AND CONSERVATION AGRICULTURE

Introduction

Gender integration across national policy processes is critical to ensure effective implementation of climate change adaptation interventions in agriculture. Various studies have shown that men and women farmers often have different abilities to adapt to climate change, variability, and weather related shocks, with women in many cases being affected more than men from climate related shocks and stresses. Women contribute significantly to agricultural production in activities ranging from cropland preparation and sowing to harvesting, livestock management, and post-harvest activities. Nevertheless, their considerable involvement highlights the need to address the gender gap in terms of access to resources, productivity, and vulnerability in agriculture in the wake of climate change. This has been attributed to women's limited access to timely weather forecast information; limited available options for crop and livelihood diversification; lack of independent source of income, access to credit or financial institutions for better investment; and low decision-making power to apply adaptation measures. Consequently, there is a difference in adaptive capacities and vulnerabilities to climate change of men and women in agriculture.

Learning Objectives

By the end of this sub-module, the trainees will be able to:

1. Introduce extension providers and other stakeholders to gender issues in CSA and CA farming systems
2. Understand gender issues in agriculture in Kenya, especially in relation to CC and CV,
3. Enhance capacity of farmers to adopt CA principles and practices for various crops production
4. Examine existing policy gaps with respect to gender integration in CC and CV in Kenya's agriculture policies.

Key Points

- Gender issues are critical in CSA and CA activities
- Adaptation and mitigation to CC forms an essential part of commitments and involves various stakeholders including national, regional, and local level government bodies as well as the private sector
- In countries where women play a key role in agricultural production, the extent of gender inclusiveness policies plays an essential role in determining the success of adaptation and mitigation actions in agriculture

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MODULE 2

NATURAL RESOURCE MANAGEMENT

Introduction

Natural resources management (NRM) refers to the management of resources such as land, trees, water and air to ensure their continued availability for current and future generations. Natural resource management involves interactions between people and natural landscapes with their associated ecologies.

Integrated natural resource management and community-based natural resource management technologies will be used for restoration and rehabilitation of agricultural landscapes as well as for improving livelihoods. Integrated Natural Resources Management (INRM) is an approach that integrates research of different types of natural resources into stakeholder-driven processes of adaptive management and innovation to improve livelihoods. It also leads to agro- ecosystem resilience, agricultural productivity and environmental services at community, eco-regional and global scales of intervention and impact. INRM has emerged as a necessary approach to solve problems of agricultural communities. Community-based natural resource management refers to the process of involving local communities in the management of these resources with the objective of both conserving the environment but also ensuring socio-economic development of local communities.

This training manual seeks to equip trainers, working in a rural context with information and skills to carry out activities related to INRM and community-based natural resource management.

These activities range from raising awareness about natural resource depletion, to facilitating discussions surrounding equitable use of natural resources, to approaching government and other agencies to ensure that local communities benefit from resource use in the areas.

List of Sub Modules

1. Land degradation and sustainable agriculture
2. Integrated soil fertility and water management
3. Soil and water management
4. Problematic soils and their management
5. Irrigation and drainage
6. Agroforestry systems

SUB-MODULE 1: LAND DEGRADATION AND SUSTAINABLE AGRICULTURE

Introduction

Land degradation is described by the 1994 United Nations Convention to Combat Desertification (UNCCD) as some measurable loss of the "biological or economic productivity and complexity of rain fed cropland, irrigated cropland, or range, pasture, forest and woodlands … arising from human activities and habitation patterns". According to the IPCC land degradation is a **negative trend** in land condition, caused by direct or indirect **human-induced** processes including anthropogenic climate change, expressed as **long-term reduction or loss** of at least one of the following: biological productivity, ecological integrity or value to humans (IPCC, 2019). Degradation of semi-natural and natural lands has received heightened attention as a global policy problem. Recent advances in supporting farmer innovation to restore land have been illustrated in a five step guide for applying the options by context approach to land restoration at the World Agroforestry Centre (ICRAF).

Learning Objectives

By the end of this sub-module the trainee should be able to;

1. Describe land degradation, restoration and rehabilitation
2. Understand the causes, types, effects and solutions to land degradation

Key Points

Soil degradation, its causes and management

- Effects of soil degradation
- Solutions to soil degradation
- Soil degradation and sustainable agriculture

Reference Materials

Esilaba, A.O., Nyongesa, D., Okoti, M., Otipa, M. and Lusike Wasilwa. (2021). KCEP-CRAL Integrated Soil Fertility and Water Management Extension Manual. Kenya Agricultural and Livestock Research Organisation, Nairobi, Kenya.

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SUB-MODULE 2: INTEGRATED SOIL FERTILITY AND WATER MANAGEMENT

Introduction

Soil management is the application of operations and practices that enhance soil health and performance. These practices may be broadly classified as soil fertility management by application of fertilisers, adoption of practices that enhance maximum soil moisture retention and minimum plant nutrient losses or loss of soil biodiversity.

Soil management is sustainable if the supporting, provisioning, regulating, and cultural services provided into the soil are maintained or enhanced without significantly impairing its functions

Sustainable soil management is fundamental to effective soil function, particularly in intensive production systems where optimal plant growth is required to deliver maximal crop yield and quality. In intensive cropping systems, when sustainable soil management is not practised, soil structural degradation in all forms is widespread and pervasive.

There is, therefore, a need to develop appropriate soil nutrient and cropping systems that minimise the need for chemical fertilisers and also find ways to integrate livestock into the farming system.

The focus of any soil fertility replenishment should be integrated nutrient management involving the application of leguminous mulches, agroforestry, and composting as well as technologies that reduce the risks of acidification and salinization.

Learning Objectives

By the end of this sub-module the trainees should be able to:

1. Describe the causes of declining soil fertility and the importance of integrated soil fertility and water

management
2. Discuss integrated soil fertility technologies, innovations and management practices.

Key Points

- Soil fertility management
- Integrated soil fertility management (ISFM)
- Assessment of soil health: Tools for assessment – soil sampling and testing
- Organic fertilisers
- Inorganic fertilisers
- Fertiliser application methods

Reference Materials

Esilaba, A.O., Nyongesa, D., Okoti, M., Otipa, M. and Lusike Wasilwa. (2021). KCEP-CRAL Integrated Soil Fertility and Water Management Extension Manual. Kenya Agricultural and Livestock Research Organisation, Nairobi, Kenya.

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SUB-MODULE 3: SOIL AND WATER MANAGEMENT

Introduction

Conservation of soil and water resources is important for the sustainability of agriculture and environment. The concept of soil conservation cannot be materialised without conserving and efficient use of water resources. Soil and water conservation can be carried out through tillage management or in-situ water harvesting as well as ex-situ.

Water is a scarce resource in Kenya; its conservation and sustainable use is important to farmers. Sustainable agriculture conserves water and soil through a variety of methods. Soil management is the prevention and reduction of the amount of soil lost through erosion. It seeks to increase the amount of water seeping into the soil and reduce the speed and amount of water run-off. Water management involves improving water use efficiency and minimising losses of water from evaporation, runoff or drainage. This includes various techniques, such as storing water in reservoirs to allow it to sink into the soil and increase soil moisture levels. It also includes using a protective cover of vegetation on the soil surface to slow down the flow of running water and spread the water over a large area.

In addition to many of the practices already mentioned (agronomic measures, agroforestry, residue management, mulching, and trash lines), there are also many structural measures which can help to conserve soil and water.

Learning Objectives

By the end of this sub-module the trainees should be able to:

1. Describe soil and water management practices
2. Discuss the benefits of soil and water management technologies to more effectively manage soil and water in agriculture landscapes

Key Points

Tillage management

- Effects of tillage on plants and soils
- In-situ water harvesting
- Ex-situ water harvesting
- Soil and water conservation measures
- Future perspectives for soil and water conservation

Reference Materials

Esilaba, A.O., Nyongesa, D., Okoti, M., Otipa, M. and Lusike Wasilwa. (2021). KCEP-CRAL Farm-level agricultural resilience and adaptation to climate change extension Manual. Kenya Agricultural and Livestock Research Organisation, Nairobi, Kenya.

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SUB-MODULE 4: PROBLEMATIC SOILS AND THEIR MANAGEMENT

Introduction

Problematic or problem soils refer to soils that possess characteristics that make them uneconomical for the cultivation of crops without adopting proper reclamation measures. There are three major types of problem soils.

- Physical problem soils-- Physical problematic soils are soils whose physical properties have some limitations. They include: include: impermeable soils, soil surface crusting and sealing, subsoil hardpan, shallow soils, highly permeable soils, heavy clay soils and fluffy paddy soils
- Chemical problem soils--Soils with chemical problems include: acid soils and salt affected soils.
- Biological problem soils--These include soils with low organic matter content and harmful macro and microorganisms. Bacterial wilt, Fusarium wilt and nematodes are some of the unfavourable biological soil pathogens.

Learning Objectives

By the end of this sub-module, the trainees should be able to:

1.Describe problematic soils and their management
2. Understand the causes, types, effects and management of problematic soils

Key Points

Problematic soils and their management:

- Soils with physical problems for agricultural production

- Soils with unfavourable chemical properties for agricultural production
- Soils with unfavourable biological properties for agricultural production

Reference Materials

Esilaba, A.O., Nyongesa, D., Okoti, M., Otipa, M. and Lusike Wasilwa. (2021). KCEP-CRAL Integrated Soil Fertility and Water Management Extension Manual. Kenya Agricultural and Livestock Research Organisation, Nairobi, Kenya.

SUB-MODULE 5: IRRIGATION AND DRAINAGE

Introduction

In the dry lands of sub-Saharan Africa, water deficit is the most important environmental factor limiting yields in agriculture. When irrigated, these areas can have a high yield potential because of the high solar radiation, favourable day and night temperature and low atmospheric humidity, conditions that decrease the incidence of pests and diseases compared to areas in temperate zones. The key to maximising crop yields per unit of supplied water in dry lands is ensuring that as much as possible of the available moisture is used through plant transpiration and as little as possible is lost through soil evaporation, deep percolation and transpiration from weeds.

In recent years there has been growing concern at the performance of conventional irrigation systems in sub-Saharan Africa. The poor performance of irrigation projects seems to have contributed to stagnation in new irrigation development. Available data suggest that irrigation potential in the region is considerable but largely unexploited.

The anticipated long-term yield increases for irrigated land which earlier depended on unpredictable and unreliable rainfall have not always been achieved. This has contributed to irrigation losing its appeal as an investment strategy. Good performance in irrigation systems is not only a matter of high output but also of efficient use of available resources. For example, the inefficient use of irrigation water in arid areas is not only wasteful but often leads to salinization of the soil profile. Irrigation systems that are to be effective and efficient must ensure that drainage, maintenance of soil fertility and salinity-control measures are employed.

Learning Objectives

By the end of this sub-module, the trainees should be able to:

1. Describe the suitable methods of irrigation
2. Discuss the benefits of irrigation technologies, innovations and management practices

Key Points

- Major methods of irrigation
- Surface irrigation
- Sub-surface irrigation

Reference Materials

Ayers, R.S. and Westcot, D.W. (1976). *Water quality for agriculture*. Irrigation and Drainage Paper No 29. Rome: FAO.

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SUB-MODULE 6: AGROFORESTRY SYSTEMS

Introduction

Agroforestry is the deliberate growing of woody perennials (trees, shrubs) as agricultural crops alongside other crops and/or livestock in the same land. Existing trees can be protected and managed, or/and new ones planted. It is estimated that trees occur on 46% of all agricultural lands and support 30% of all rural populations. Trees are used in many traditional and modern farming and rangeland systems.

Agroforestry has three major attributes: productivity, sustainability and adaptability. Good agroforestry practices should maintain or increase production (productivity), meet the needs of the present generation without compromising those of future ones (sustainability), be culturally acceptable, and environmentally friendly (adoptability).

Learning Objectives

By the end of this sub-module, the trainees should be able to:

1. Describe specific agroforestry techniques
2. Understand the agroforestry technologies, innovations and management practices

Key Points

- Components of an agroforestry system
- Some of the agroforestry tree species in East Africa
- Getting started with agroforestry systems
- Common agroforestry systems and land-use

Reference Materials

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MODULE 3
CROP PRODUCTION AND MANAGEMENT

Introduction

Crop production is a common agricultural practice used worldwide to produce food feed and raw materials for industries. Agro pastoralists undertake crop production and cultivate land under marginal and fragile environments requiring targeted technologies, innovations and management practices to promote restoration and rehabilitation after a natural calamity or disaster has occured. This section covers production practices of crops that are suitable for arid and semi-arid lands under rain fed agriculture in addition to a selection of high value crops that can be grown under irrigated horticultural production in the areas where water harvesting can be practised.

This module consists of six sub-submodules

1. Crop value chains suited for ASAL agro-ecological zones
2. Cropping systems and technologies
3. Integrated pest and disease management
4. Safe use of pesticides
5. Harvesting and post-harvest management

SUB - MODULE 1: CROP VALUE CHAINS SUITED FOR ASAL AGRO-ECOLOGICAL ZONES

Introduction

The need for identification and targeting of suitable crops and crop varieties to different agro-ecological zones cannot be overemphasised for increased agricultural productivity and output. Inadequate information and skills as well as poor market information makes it difficult for farmers to engage in certain crop enterprises. This sub module provides guidance on the relevant skills and information needed to promote crop value chains for the targeted agro ecological zones.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Identify the crop value chains for the targeted agro-ecological zones
2. Describe key management practices for the identified crop value chains

Key Points

- Selected crop value chains for rehabilitation and restoration programs in ASALs:
  - Cereals – Sorghum and finger millet
  - Legumes – Pigeon peas, green grams and cowpeas
  - Fruit Trees – Mango
  - Horticultural crops - Watermelon, tomatoes, onions, capsicum
- Varieties and variety selection for the selected crop value chains
- Ecological requirements for different selected crop value chains
- Management/agronomic practices for the selected crop value chains

Reference Materials

Esilaba, A.O., Nyongesa, D., Okoti, M., Otipa, M. and Lusike Wasilwa. (2021). KCEP-CRAL Green Gram Extension Manual. Kenya Agricultural and Livestock Research Organisation, Nairobi, Kenya

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Katama, C.K. and Pole, F.N. (2010). Make money from mango products: Mango Juice. Wasilwa, L.A., Muinga, R.W. and Rege, R.A. (eds). Kenya Agricultural Research Institute, Mtwapa, Kenya.

SUB - MODULE 2: CROPPING SYSTEM AND TECHNOLOGIES

Introduction

A cropping system refers to the type and sequence of crops grown and practices used for growing them. It encompasses all cropping sequences practised over space and time based on the available technologies of crop production. Cropping systems are an important part of sustainable agricultural production.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Define the components of a cropping system
2. Design a cropping system

Key Points

- Types of Cropping systems; Mixed farming; crop rotation; Intercropping; Relay cropping; Alley cropping, Organic farming and Kitchen gardening
- Importance of each cropping system
- Designing each cropping system

Reference Material

Recha, J., Kapukha, M., Wekesa, A., Shames, S. and Heiner, K. (2014). Sustainable Agriculture Land Management Practices for Climate Change Mitigation: A training guide for smallholder farmers. Washington, DC. EcoAgriculture Partners.
Mohler, C.L. and Johnson, S.E. (2009). Crop rotation on organic farms: a planning manual. Ithaca, NY: Natural Resource, Agriculture, and Engineering Service (NRAES) Cooperative Extension.
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IFOAM. (2003). Training Manual for Organic Agriculture in the Tropics. Edited by Frank Eyhorn, Marlene Heeb, Gilles Weidmann (eds). p 124-129, 149-155, http://www.ifoam.bio/
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SUB - MODULE 3: INTEGRATED PESTS AND DISEASE MANAGEMENT (IPDM)

Introduction

This sub-module presents guidelines for appropriate management of pests and diseases for enhanced food security and livelihoods in areas affected by desert locust invasion and drought in the northern frontier counties. Insects, diseases and weeds continue to devastate crop production in the country. This sub-module will therefore provide the basis and methods to manage these problems including the use of pesticides or biological pest control.

Learning Objectives

By the end of this sub- module the trainee should be able to

1. Define a pest
2. Define integrated pest management (IPM)
3. Enumerate advantages and disadvantages of IPM

4. Describe the principles of IPM and the role they play for successful pest management
5. Appreciate the role of various decision – making tools in IPM

Key Points

- Different types of pests, diseases and weeds that compete with other organisms in the environment.
- Integrated Pest, Disease and Weeds management (IPD & WM) system and its importance in the management of pests, diseases and weeds
- Principles of Integrated Pest Management
- Pest Management Decision Making process
- Pest management decision making process involves:

Reference Materials

Ajayi, O.C. and Akinnifesi, F.K. (2007) Farmers' understanding of pesticide safety labels and field spraying practices: a case study of cotton farmers in Northern Cote d'Ivoire. Scientific Research and Essays 2: 204-210.

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SUB - MODULE 4: SAFE USE OF PESTICIDES

Introduction

Pesticide is any chemical substance that is used to prevent or reduce loss or damage caused by pests, either by directly killing the pest, or by inhibiting its growth, or repelling it. They are widely used to protect crops and livestock from losses due to insects, weeds, and diseases. Safe use of pesticide is the proper handling of chemicals before, during and after use for a guaranteed safe environment.

Learning Objectives

By the end of the sub-module, the trainee should be able to:

1. Define pesticide as a component in IPM
2. Identify different classification of pesticides and their formulation
3. Describe effective, safe use and handling of pesticides
4. Explain the health hazards and toxic effects of pesticides to humans and animals
5. Describe the direct and indirect impacts of pesticides on the environment

Key Points

- Definition of Pesticide and Safe Use
- Importance of safe use of pesticides
- How pesticide enter the body
- Harmful effects of pesticides
- The general symptoms and signs of acute pesticide poisoning can be categorised as:
    - Personal protective equipment
    - Classes of pesticides and their formulation
    - Safe Use and Handling Pesticides before, during and after
    - First aid measures

Reference Materials

FAO (2014). Food and Agriculture Organisation. Evaluation of field trials data on the efficacy and selectivity of insecticides on locusts and grasshoppers. Report to FAO by the Pesticide Referee Group, 10th meeting. Gammarth, Tunisia.

6th Report of FAO/WHO Joint Meeting on Pesticide Management and 8th Session of the FAO Panel of Experts on Pesticide Management, 9 – 12 October 2012.

MODULE 4
LIVESTOCK PRODUCTION AND MANAGEMENT

Introduction

Livestock production is the main enterprise in the pastoral and agro pastoral production systems. The optimal utilisation of these production systems can lead to improved livelihoods of communities that predominantly rely on livestock for survival. Knowledge on nutrition, breeding, animal health and management practices that enhance the utilisation of the ecosystem for production of livestock products from poultry, shoats, cattle and camels amongst other species has great potential of improving the livelihoods of livestock keepers, particularly in the ASAL areas. There is therefore a need to enhance the livestock keeper's ability to mitigate the effects of various emergencies and plan for appropriate interventions. Some of the key interventions in the livestock sector are discussed below as sub-modules.

Sub - Modules

1. Livestock breeds characteristics
2. Pasture and fodder production
3. Pasture and fodder conservation
4. Feed formulation
5. Sheep and goats production
6. Indigenous chicken production
7. Camel production
8. Body weight and body conditioning scoring
9. Destocking and restocking
10. Animal Health Interventions
11. Provision of water

SUB-MODULE 1: LIVESTOCK BREEDS AND PERFORMANCE CHARACTERISTICS

Kenya is endowed with a rich diversity of livestock species and breeds which are of great economic, social and cultural importance. These include cattle, sheep, goats, camels, poultry, which are either indigenous or exotic. Kenya's animal genetic resources are estimated at 20,529,191 cattle, 26,745,916 goats, 18,983,760 sheep, 3,222,593 camels and 44,624,453 domestic birds. They are exploited in diverse climatic conditions namely; Hyper Arid, Arid, Semi-Arid, Sub-Humid, Humid, and Afro-Alpine environments, and production systems that range from low input intensive to high input intensive systems. Whereas the indigenous livestock breeds are adapted to a variety of production environments under low input production systems, the exotics have been developed for increased production per unit under high input production systems. Each species used for food and agriculture comprises several breeds, groups, genotypes and strains, with considerable diversity existing within species and breeds/ecotypes.
The subsections in this guide will contain information on different breed types and their characteristics including morphology, production and reproduction potential.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. The differentiate the different livestock breed types for the various species
2. Identify the potential performance of the various breeds
3. Determine suitability of breeds to particular environments

Key Points

- Create awareness on the different livestock breeds in Kenya
- Comparison of the performance traits for the various breeds within species
- Identify breed compatibility during cross breeding
- Appreciate the distribution of various ecotypes across the country
- Determine the breeding potential of the different livestock breed

SUB-MODULE 2. PASTURE AND FODDER PRODUCTION

Introduction

Cattle, sheep and goats are the most common ruminants kept in the farms. Their production is primarily based on pastures and fodders (forages) as source of feed. Kenya, and indeed the whole of East African region, is widely recognized as the home for many important forages. In this Sub-Module, selected important forages are described and their relevance in livestock production.

Learning Objectives

By the end of the Sub-module, the trainee should be able to:

- Appreciate the role of pastures and fodders availability in both quantity and quality for their livestock,
- Understand climatic requirements, adaptation, husbandry practices and management options for various pasture and fodder species,
- Have aspects of feeds nutritive value and utilization, with consideration complementarity, explained for application.

Key Points

- Characteristics of selected pastures and fodder species,
- Climatic Suitability and Yield potential of pastures and fodders,
- Importance of feed Palatability and Digestibility,
- Feeds nutritive value,
- Limitations and considerations for cultivation of different feed resources,
- Companion species that can be grown together for complementarity.

Reference Materials

Kaitho, R.J. (1997). Nutritive value of browses as protein supplements to poor quality roughages. PhD Thesis, Wageningen University. The Netherlands.

MacDonald, P., Edwards, R.A. and Greenhalgh, J.F.D. (1988). Animal Nutrition, 4th Edition. Longman, UK.

Muyekho, F.N., Mwendia, C. W. and Lusweti, F. (eds) (1999). Support to dairy cattle nutrition in Kenya. An Advisory booklet for Extension workers. KARI/DFID National Agricultural Research Project-NARP II.

Ouda, J.O. and Nsahlai, I.V. (2007). Nutritive value of maize stovers harvested at two different stages of maturity and mixed with different types and levels of protein supplements. Journal of Applied Animal Research. 32:89-95.

SUB-MODULE 3: PASTURE AND FODDER CONSERVATION

To sustain production, availability of good quality feeds all year round is essential. In Kenya, feed availability dwindles, particularly during the dry seasons forcing most farmers turn to crop residues, where available. The crop-residues utilization is limited by low quality, often too low to support any reasonable production. Because of seasonal cycle of feed availability, the remedy to sustained supply of feeds is adoption of appropriate feed conservation at farm level. In this Sub-module some key methods that farmers can use to conserve feeds for guaranteed availability throughout the seasons and year are covered.

Learning Objectives

By the end of the Sub-module, the trainee should be able to:

1. Learn the importance of pasture and fodder conservation,
2. Get exposed to different methods of pasture and fodder conservation,
3. Acquire knowledge about construction of suitable hay and silage conservation structures.

Key Points

- Importance of pasture and fodder storage
- The different methods of pasture and fodder storage
- Different structures used to store pasture and fodder
- Key tips to consider for successful pasture and fodder conservation.

Reference Materials

Gachuiri, C.K. (2013). Fodder Production and conservation. KVA-SEVET, Thika. www.gardenvet.co.ke

MacDonald, P., Edwards, R.A. and Greenhalgh, J.F.D. (1988). Animal Nutrition, 4th Edition. Longman.

Ogillo, B.P., Kidake, B.K., Kirwa, E.C., Muthiani, E.N., Ndathi, A.J.N. and Mnene, W.N. (2018). Hay making and storage for livestock production in arid and semi-arid areas. www.kalro.org/asal-aprp.

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SUB-MODULE 4: FORMULATION OF CATTLE RATIONS

Cattle production in Kenya is a serious undertaking and occurs in nearly all parts of the country. The production systems and species kept vary as dictated by the agro-ecological potentials and local preferences. Among livestock, cattle is the most preferred species and predominates in most of the semi-arid, moderate potential and high potential areas. Traditionally, cattle are primarily kept for milk production. Other important uses include sale for beef, home slaughter, draught power and cultural undertakings. High cost of feeds and low levels of production are crucial challenges facing the farmers. especially in dairy production. Majority of farmers are not aware of the different nutrient requirements for the various classes of their stock, which may result to either overfeeding or underfeeding. Evidently lacking is the ability by farmers to mix the various feed ingredients to meet nutrient requirements for maintenance and for production. Considering that the cost of feeds contributes 50-70% of production expenses, imparting knowledge to farmers on the quality of their locally available feed resources and how they can be rationed to improve production is the focus of this Sub-module.

Learning Objectives

By the end of the Sub-module, the trainee should be able to:

1. Have knowledge on nutrient requirement by cattle,
2. Understand the information required for formulation of balanced cattle ration,
3. Comprehend ration formulation by different methods,

Key Points

- The essence of home-made feed rations for cattle,
- Feed quality considerations for ration formulation,
- Decide by careful calculation what feed resources to plant on the farm,
- Keeping useful records; using them for feed budgeting and ration formulation.

Reference Materials

MacDonald, P., Edwards, R.A. and Greenhalgh, J.F.D. (1988). Animal Nutrition. 4th Edition. Longman, UK.

Muia, J.M.K., Gachuiri, C.K., Mbugua, P.N., Sang, A.R. and Pheris W.M. (2007). Ration formulation for dairy cattle. Training manual for livestock extension. KALRO, Nairobi.

Ouda, J.O. and Nsahlai, I.V. (2007). Nutritive value of maize stovers harvested at two different stages of maturity and mixed with different types and levels of protein supplements. Journal of Applied Animal Research. 32:89-95.

SUB-MODULE 5: SHEEP AND GOATS

Introduction

Sheep and goats (shoats) are the most important small ruminants in Kenya. They have been identified as one major group of livestock that can have a significant impact in improving food security in Kenya. This is partly because of their efficient feed conversion ratio (FCR), their ability to make good use of diverse local forages and their relatively low requirement for space compared to large ruminants. Goats in particular can be raised as dual purpose animals producing both milk and meat. The goat meat industry is well developed. Goat dairy industry is much smaller. Over the past few years, however there has been an increase in the demand for goat's milk as the public is becoming much more aware of its nutritional benefits leading to increased opportunities in the field of dairy goat production.

Learning Objectives

1. Providing pastoralists trainers with relevant knowledge and skills in sheep and goat production as a business and market assessment techniques for market led production.

2. Refreshing pastoralists trainer's knowledge and skills in sheep and goats GAP including breeds and breeding, lambs and kids husbandry practices, feeds and feeding, manure management and animal health
3. Providing pastoralists trainers with knowledge and skills in the potential in value addition to increase the enterprise profitability
4. Providing pastoralists trainers with knowledge and skills in participatory techniques for effective facilitation of adult learning processes and developing inclusive stakeholder partnership development for sustainable up scaling.

Key Points

- Breed Selection: The first decision that must be made when establishing any livestock enterprise is the species and breeds that will comprise your herd. There are many breeds of shoats reared in Kenya. Each breed differs from the other in body size, meat characteristics, milk volume and milk composition. Proper research should be done on each breed and their performance before purchasing stock.
- Purchasing Shoats: Farmers with registration papers or good pedigree records are able to demand a higher price for their shoats, which in most cases are imported, high quality animals, but, if you are a beginner you may want to start with local less expensive animals since they tend to be more adapted.
- Animal Housing: The pen design will depend on your method of production and the financial investment you are willing to make. The ideal housing for goats should provide light with good airflow and access to clean feed, water and bedding. The pens should also be designed to allow for easy cleaning. Safe, comfortable, clean facilities are necessary for the production of high quality milk.
- Nutrition and feeding: The most important and expensive characteristic of shoats farming is nutrition. You can have the best genetic stock housed under the best conditions but without proper nutrition the animals will not perform well. Feeding dairy goats therefore involves combining various feedstuffs into an acceptable and palatable ration which will meet nutritional requirements of the animal while still being economical to the farmer.

- Herd health: To accurately identify a disease or health problem, contact your veterinarian or regional vet services office for the correct procedure, medication and dosage that will best fit the animal's health needs. As a producer, it is important that you know the basic physiological data of the sheep or goat.
- Records and Financials: A recording system starts at birth and involves permanently identifying each individual animal from the flock. Such a system is the basis for a successful shoats' production enterprise.

SUB-MODULE 6: POULTRY PRODUCTION

Introduction

Chicken meat and eggs are the best source of quality protein, and are badly needed by the many millions of people who live in poverty. In sub-Saharan Africa (SSA) and South Asia malnutrition (poor nutrition) and under nutrition (inadequate nutrition) are closely associated with poverty. These conditions affect the immune system. In Kenya indigenous chicken produces 50% of the eggs and 60% of the poultry. Over 80% of the households in Kenya keep them which are generally owned by women and children who also control the benefits accrued. Indigenous chicken are therefore a good enterprise for increasing incomes for women and the vulnerable and marginalised groups. A major proportion of incomes for women goes to food items therefore directly addressing household food security.

Learning Objectives

This training is aimed at enabling farmer trainers with knowledge and skills on how to facilitate a poultry farmer training session for increased productivity through adoption of Good Agricultural Practices (GAPs). The training will:

1. Provide the trainers with knowledge and skills on poultry breeds including establishment and management of innovative climate smart rearing technologies;
2. Empower the trainers with knowledge and skills on poultry feed formulation and production

3. Capacitate the trainers with knowledge and skills on poultry health management and biosecurity for enhanced productivity and resilience to environmental stressors
4. Provide the trainers with knowledge and skills on poultry farming as a business including marketing skills.

Key Points

- Poultry Industry in Kenya contributes to the Country's GDP
- Maintain proper poultry housing, equipment, feeds and feeding regimes. Allow the birds to scavenge to reduce costs
- Conduct chicken enterprise as a business by keeping records and standards for improved productivity and profitability
- Maintain clean environment for the chickens pertaining to housing and drinking water
- Maintain a proper ratio of cocks and hens or apply cockerel exchange system for enhancing flock productivity and performance
- Crossing the local chicken with exotic cockerels has resulted in the famous KALRO Kienyeji Chicken, which produces more eggs per laying cycle.
- Apply integrated management of pests and diseases.

References Materials

FAO. (1999). Food and Agriculture Organisation. Good practices in small scale poultry production: A manual for trainers and producers in East Africa. FAO ECTAD Regional Unit Eastern Africa, Nairobi, Kenya.

Farrell, D. (2000). A simple guide to managing village poultry in South Africa. The University of Queensland, Australia, 56pp. ISBN 0 620 26105 6.

Moran, F.T. (1996). Success in poultry keeping (for food income, work and education). 4th Impression. Longman, Harare, Zimbabwe, 128pp. ISBN: 0 908310 005.

Oosterwijk, G., van Aken, D. and Vongthilath, S. (2003). A manual on improved rural poultry production. 1st Edition. Department of Livestock and Fisheries, Ministry of Agriculture and Forestry, Vientiane, Lao PDR. VII + 115pp. ISBN: 974-91217-9-1.

SUB-MODULE 7: CAMEL PRODUCTION

Introduction

The camel (Camelus dromedary, the one-humped camel) is an important livestock species uniquely adapted to hot, arid and range environments. It produces milk, meat, wool, hair and hides. It provides long distance transport (a beast of burden), sport riding, and is a draft animal for agriculture.

In Kenya's rangelands which comprise over 70% of the land surface, camel keeping is increasingly finding its place in the livestock industry. The camel is a unique resource adapted and able to utilise the ASAL environment and may be one of the key solutions to the rampant and recurring food crisis in these areas in future.
It is a more reliable milk provider than other classes of livestock in both dry seasons and drought years. The milk provides about half of the nutrient intake of most camel keepers. The average camel produces 5-10 times as much milk as a cow kept under the same climatic conditions due to its prolonged lactation.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Understand the benefits of camel production
2. Discuss the camel distribution in Kenya
3. Describe the benefits of camel production
4. Enumerate the feeding habits of camels
5. Discuss milk yields and lactation length
6. Estimate camel water requirements.

Key Points

- Camel production Population, Breeds, distribution and adaptation to harsh environment)
- Feeds and feeding and water requirements

- Clean milk production and handling
- Milk quality
- Factors affecting yields
- Milking practice.

Reference Materials

Akweya, B.A., Gitao, C.G. and Okoth, M.W. (2010): The prevalence of common milk pathogens and antibiotic resistance of the organisms in camel milk from North Eastern Province of Kenya. Garissa: A paper presented at the International Camel Symposium.

KCA. (2009). Kenya Camel Association. (2009). Annual report. Nairobi, Kenya.

Mahmoud, H.A. (2010). Camel marketing in the Northern Kenya/Southern Ethiopia Borderlands. FAC Research Update 003. Brighton: Future Agricultures Consortium, University of Sussex; 2010.

Meile, L. (2010). Microbial biodiversity of camel milk and fermented camel milk products: Technology, hygiene and safety. Garissa: A paper presented at the International Camel Symposium.

MoLD. (2007). Ministry of Livestock Development. Annual report. Nairobi, Kenya.

Noor, I.M., Bebe, B.O. and Guliye, A.Y. (2012). Analysis of an emerging peri-urban camel production in Isiolo County, Northern Kenya. Journal of Camelid Science (5):41–61.

SUB MODULE 8: BODY WEIGHT AND BODY CONDITION SCORING

Introduction

Many livestock farmers probably do not own livestock weighing scales which are relatively expensive. Information on the weight of an animal is important in determining sale price in beef animals, amount of feed to dispense, dosage of medicine amongst other uses. Several methods have been developed to estimate weight of animals, the most common is the Dalton weigh band which calibrates physical measurements into estimated weight directly and has an accuracy of up to 95%.

It is also important for farmers to be able to determine the body condition scores of the animals to plan for nutritional intervention for marketing. Thus body condition is a good indicator of the nutritional status of the animal for marketing and nutritional management.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Ability to estimate the weights of animals for marketing and Management purposes
2. Utilisation of indirect methods to determine Various weight measurements
3. Be able to determine body condition for marketing or management decisions on feeding
4. Determine right conditions of the animal for breeding and other management practices
5. Weight may be used to determine dosage for medication

Key Points

- Various methods of determining body weight of various classes of animals
- Simplified options to determine weight at various physiological stages
- Body condition scoring is a management tool designed to assess body reserves or fat accumulation of an animal.
- It is a great method for critically examining the nutritional status of the herd.
- Body condition scoring is a hands-on assessment that uses a numerical rating system based on the feel of the animal to assess body fat accumulation.
- A 9-point scale (1, 2, 3, 4, 5, 6, 7, 8, 9) is used to categorize livestock from thin to obese, but at times a 5-point scale (1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5) may be used. Both scales use identical criteria, but assign different numbers to the criteria.

Reference Materials

Abebe, D., Cullis, A., Catley, A., Aklilu, Y., Mekonnen, G. and Ghebrechirstos, Y. (2008). Livelihoods impact and benefit-cost estimation of a commercial destocking relief intervention in Moyale district, southern Kenya.

Disasters, 32/2, June 2008.
Anon. (2007). Livestock Emergency Guidelines and Standards - Second Consultative Draft November 2007, http://www.livestock-emergency.net
Anon. (2003). Livestock Interventions: Important Principles for OFDA. Office for Foreign Disaster Assistance, Washington DC http://www.usaid.gov/our_work/ humanitarian_assistance/disaster_assistance/resources/pdf/livestock_guidances_11-19-02.pdf

SUB-MODULE 9: DESTOCKING AND RESTOCKING

Introduction

During calamities, particularly drought, in pastoral areas a substantial number of livestock do perish, and communities lose some or all of their animals. Recovery of herds after drought can take many years, during which time households remain dependent on local support mechanisms or external aid. Alternatively, after the calamity, restocking programs may assist some households but are far more expensive than pre serving key livestock assets during a drought. At a time when market prices for livestock can be falling, destocking aims to convert non-essential livestock into resources - mainly cash or meat - which people can use during the drought.

A restocking program aims to rebuild a productive livestock holding for pastoralist households that have lost most of their animals as a result of an emergency, and have no means of their own to recover. Restocking may be appropriate after various types of disasters, such as drought, flood or conflict. Almost by definition, restocking takes place after an emergency although in the case of a slow onset emergency, some degree of forward planning may be possible. Relative to most other types of interventions, restocking is an expensive option because it requires the replacement of livestock. It follows that in most restocking programmes, the number of recipient households is very much determined by resources available.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Define the terms Destocking and Restocking.
2. Describe the categories of Destocking.
3. Describe the process of Restocking.
4. Discuss the types of livestock restocking.
5. Describe other available intervention means besides Restocking.

Destocking is categorised as follows:
Commercial destocking; Involves the engagement of livestock traders to boost livestock off-take from a calamity-affected area so that they can be fattened and sold through terminal markets at good prices before the animals deteriorate. This type of destocking provides pastoralists with cash, which they can then use to buy other commodities and services they need, including items to protect their remaining livestock. This type of destocking should take place as soon as possible, at the onset of the calamity.

Slaughter destocking; based on the purchase of livestock by an aid agency, followed by immediate, local slaughter and the distribution of meat to the community. This type of destocking takes place during the advance stages of the calamity, at a time when livestock traders are no longer purchasing poor conditioned livestock.

Key Points

- Distinguishing between the two categories of destocking.
- Linking the producers to cattle traders and how to manage the slaughter destocking in terms of handling the meat hygienically and its preservation.
- Understanding the right time to undertake the relevant destocking category in order to optimise the resources accruing to the farmers. These interventions should start at the right time of the calamity cycle to reduce the losses from the calamity
- The value of animals salvaged in this way has generally been minimal although some useful lessons have been learnt that now have the potential to support the design of more effective destocking programs.
- Operational costs of managing the scheme including transport and managing the cold chain and necessary

links to the traders
- Cost of procuring the animals.
- Animal health interventions.
- Provision of feed and water
- Overhead costs, including maintaining holding facilities, animal losses, administration etc.
- Monitoring and impact assessment costs

Reference Materials

Abebe, D., Cullis, A., Catley, A., Aklilu, Y., Mekonnen, G. and Ghebrechirstos, Y. (2008). Livelihoods impact and benefit-cost estimation of a commercial destocking relief intervention in Moyale District, southern Kenya. Disasters, 32/2, June 2008.

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SUB-MODULE 10: ANIMAL HEALTH INTERVENTIONS

Introduction

Provision of veterinary services during drought or other disasters, is an important strategy for assisting pastoralists to protect their livestock and maintain the benefits of livestock ownership or access. In pastoral communities where livestock are highly regarded as a capital asset, veterinary care can help to prevent sudden loss of livestock due to acute diseases which cause high mortality. In situations where high livestock mortality occurs, it can take many years for communities to rebuild their livestock assets. Veterinary care also helps in reducing the impact of chronic diseases which may affect benefits such as milk production, fertility or the use of livestock as draught animals. In general, veterinary vaccines and medicines are inexpensive items relative to the economic value of livestock.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Outline the benefits of Livestock ownership
2. Justify the essence of livestock as a capital asset
3. Prevent sudden loss of Livestock due to acute diseases
4. Promote veterinary care as a means of reducing the impact of chronic diseases which in the end affect benefits such as milk production, fertility etc
5. Promote emergence of community-based animal health workers.

Key Points

In pastoral areas of Kenya the trend in recent years has been towards the privatisation of clinical veterinary services, with increasing use of private veterinary suppliers to support primary-level workers such as community-based animal health workers (CAHWs).The emergence of these approaches in pastoral areas demonstrates the willingness and capacity of pastoralists to pay for basic veterinary services.

There are two main types of veterinary interventions during drought and other calamities as follows:

- Support to the private sector for primary clinical veterinary care – the prevention and treatment of livestock diseases which cause high mortality or substantial production losses.
- Support to government veterinary services, particularly for disease surveillance, disease control, veterinary public health, and other functions as needed.
- Coordination issues and other types of intervention.
- General approaches and principles to clinical veterinary care.

Reference Materials

Aklilu, Y. (2003). The impact of relief aid on community-based animal health programmes: The Kenyan experience. Sones, K. and Catley, A. (eds). Primary animal healthcare in the 21st century: Shaping the rules, policies

and institutions. Proceedings on an international conference, 15-18 October 2002. Mombasa, Kenya, African Union/Interafrican Bureau for Animal Resources, Nairobi, Kenya.

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SUB-MODULE 11: WATER FOR LIVESTOCK

Introduction

Water is an essential component in the survival of livestock. Therefore, in emergency situations where water sources have been seriously compromised, the provision of alternatives is of the highest priority. Even where water is currently available, relief programs need to assess, and if necessary, implement appropriate responses to potential and future threats to water sources to ensure that other relief efforts are not undermined by water shortages. The practical implications of providing water to livestock should be considered carefully and in parallel with the need for animal feeds and veterinary care.

Water may be available from a range of sources and deliverable by a number of means. This can at times complicate, or ease the selection of appropriate interventions capable of matching supply with demand. However, the need to distribute water effectively is often so acute that expensive and unsustainable methods such as water trucking may need to be considered in the short term at least.

In an emergency situation, access to water may be provided for livestock owners in one of three ways:

- Improving the management and capacity of existing water points to provide broader access to affected populations.
- Rehabilitation of existing but degraded water points.
- Establishment of new water points.

Typical water sources in Kenya may include:

- Ground water sources (e.g. hand dug wells, boreholes and spring protection schemes)
- Surface water harvesting systems (e.g. direct extraction from rivers, lakes and ponds, check dams and subsurface dams)
- Rainwater collection (e.g. rooftop collection, runoff drainage')

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Describe Options for water provision
2. Evaluate Water distribution
3. Analyse Complementary water interventions
4. Conduct Needs and feasibility assessments of water sources.

Key Points

- Water source selection and intervention design
- Supply and demand
- Costs involved
- Distribution
- Water safety and quality

Reference Materials

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MODULE 5
RANGELANDS IMPROVEMENT AND REHABILITATION

Introduction

Rangelands are lands on which the vegetation is predominantly grasses, grass-like plants, forbs or shrubs and is managed as a natural ecosystem. They include annual and perennial grasslands, shrub and dry woodlands, savannah, tundra, and desert. These areas provide many goods and ecosystem services of vital importance for local communities hence sustenance of livelihoods. However, most of these lands are becoming degraded as a result of human and climate induced factors with over 75% of Africa's drylands affected by moderate to high degree (Olukoye and Kinyamario, 2009).

The overall aim in this module is to provide different approaches to rehabilitate or restore denuded/degraded rangelands to its natural state through approaches that aim to increase vegetation cover, biodiversity and create resilient environments. Rangeland infrastructure improvement is also primary to the development of livestock production and will be discussed. Community involvement is key in most cases while addressing land and natural pasture degradation, which ensures access to benefits accruing from the efforts of restoring and protecting the environment.

Lists of Sub-Modules

a. Range reseeding and rehabilitation,
b. Use of enclosures and grazing management,
c. Holistic planned grazing and range improvement,
d. Invasive species and management,
e. Rangeland infrastructure development

SUB-MODULE 1: RANGE RESEEDING AND REHABILITATION

Introduction

Over 33% of the global land and 30% of the Kenyan land area is degraded compromising their ability to provide ecosystem goods and services. This degradation is brought about by several factors, mainly human induced activities and climate change. Some of the common causes of rangeland degradation include inappropriate land uses and agricultural practices, overgrazing or cutting of vegetation and drought that lead to deterioration and erosion of soil properties and the environment. Frequent and prolonged droughts that are currently being experienced contribute to loss of vegetation cover, changes in vegetation composition, species rarity, bush encroachment, weed invasion and water scarcity.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Describe the various strategies of approaches of range reseeding and management
2. Discuss various species (grasses and legumes) for reseeding
3. Understand the process of rangeland pasture seed production and multiplication.

Key Points

- Natural pasture degradation
- Approaches to rangeland rehabilitation and reseeding
- Understanding the site conditions
- Rangeland Pasture seed production and multiplication
- Species selection - identify key adaptable species
- Land preparation, planting methods and Seeding rates
- Pasture management - Weed, fertiliser and manure management, pests and disease control

- Forage and pasture utilisation- grazing, hay, cut-carry, silage
- Forage seed harvesting and management technologies
    - Seed harvesting, harvesting methods
    - Processing (threshing, cleaning, sorting, packaging)
    - Seed storage (requirements for storage)
    - Monitoring for seed viability and quality

Reference Materials

Abhilash, P.C. (2021). Restoring the unrestored: Strategies for restoring global land during the UN decade on ecosystem restoration (UN-DER). Land,10 (201). https://www.mdpi.com/2073-445X/10/2/201

Bolo, P., Sommer, R., Kihara, J., Kinyua, M., Nyawira, S., and A. Notenbaert. (2019). Rangeland Degradation: Causes, Consequences, Monitoring Techniques and Remedies. In Working Paper (No. 478).

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SUB-MODULE 2: USE OF ENCLOSURES AND GRAZING MANAGEMENT

Introduction

Enclosures are areas closed-off from any interference from both humans and animals with the aim of promoting the natural regeneration of plants and reducing land degradation on formerly degraded grazing land. The protection period or rest time allows vegetation to regenerate and produce seed for harvesting or self-seeding. This allows for natural regeneration hence improving plant species composition, abundance and diversity among other benefits. This can be done together with reseeding and grazing management to enhance the outcome of the rehabilitation.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Describe the use of enclosures as a rangeland rehabilitation tool
2. Understand how enclosures are managed and utilised

Key Points

- Rangeland enclosure ownership, access and utilisation
- Livestock grazing strategies (grazing management)
- Enclosure categories – private, communal, spontaneous
- Grazing management - organising livestock to make the best use of managed pastures
- Monitoring of enclosures

Enclosures and Grazing Management

How to prepare and manage enclosures

- Areas demarcation, protection and management
- Complementary Management of enclosures – reseeding, micro catchments, manure management, water harvesting structures

- Utilisation and grazing management of enclosures

Benefits of Enclosures

Some benefits of having enclosures include: - increased quantity & quality of pastures, controlled grazing, increased plant diversity and other ecosystem services. This leads to reduced livestock migration, enhanced livestock management and productivity and reduced animal losses.

Reference Materials

Behnke, R.H. (1986). The implications of spontaneous range enclosure for African livestock development policy. African Livestock Policy Analysis Network Paper No. 12. *ILCA, Addis Ababa, Ethiopia*, *2000*(12), 2–3. https://cgspace.cgiar.org/bitstream/handle/10568/4255/x5506e.pdf?sequence=1&isAllowed=y

Knutsson, P., Mureithi, S., Wredle, E. and Nyberg, G. (2021). Perspectives on enclosures in pastoralist drylands: From contradictory evidence to the formulation of innovative land management strategies. *World Development Perspectives 23* 100351. https://www.sciencedirect.com/science/article/abs/pii/S2452292921000679

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SUB-MODULE 3: HOLISTIC PLANNED GRAZING FOR RANGE IMPROVEMENT

Introduction

A concept developed in the 1960s by a range scientist, Allan Savory. It is a strategy for regenerating a degraded area and the livelihoods while utilising ecologically, socially and economical sound activities. Similar to rotational grazing but recognizes four ecosystem processes, namely, water cycle, nutrient cycle, energy flow and community dynamics. It is cost-effective, uses nature-based solutions and is highly scalable and sustainable because it increases land productivity, livestock stocking rates while ensuring the wellbeing of the community.

This is based on the hypothesis that domestic livestock can substitute for wild animal herds that previously utilised the natural vegetation in a sustainable way. These natural herds of wildlife grazed, defecated, stomped and salivated as they moved around and utilised the land without degrading it.

Learning Objectives

1. To enhance knowledge on the use of holistic management technology in range restoration

Key Points

Approach and Principles of holistic management

- Animal impact as a tool - livestock
- Grazing as a tool - management
- Seasonal planning
- 'Big picture' consideration – wildlife, livestock, plants, soils, people etc.

Commonly used tools are money/labour, human creativity, grazing, animal impact, fire, rest, living organisms and technical knowledge

What are some of the benefits of Holistic Management?

These include increased ground cover, increased water infiltration and moisture retention, reduced soil erosion, increased organic matter, improved wildlife habitat and healing the environment.

Reference Materials

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Neely, C.L. and Butterfield, J. (2004). Holistic management of African rangelands. Magazine on Low External *Input and Sustainable Agriculture, 20*(4), 26–28. https://edepot.wur.nl/91032

https://savory.global/wp-content/uploads/2017/02/about-holistic-planned-grazing.pdf

SUB-MODULE 4: INVASIVE SPECIES MANAGEMENT

Introduction

Invasive plants: Plants that have, or are likely to spread into native or minimally managed systems and cause economic or environmental harm by developing self-sustaining populations and becoming dominant or disruptive to those systems. Invasive species are an emerging problem in the dry lands creating disasters and directly affecting communities in the arid and semi-arid lands. Many regions in the dry land of Kenya are currently under the threat of invasive species.

Examples of these species in Kenya include: - *Ipomoea spp*, *Prosopis juliflora* (Mesquite), commonly called "Mathenge", red bark acacia (*Acacia reficiens)*, Prickly pear (*Opuntia ficus*), water fern, Water hyacinth, White thorn acacia (*Acacia polyacantha)*, Common lantana (*Lantana camara), Commiphora africana* and *Parthenium hysterophorus* (Parthenium weed).

There is a need to manage and mitigate the impacts of invasive species in the dry lands to safeguard and build resilience of communities affected.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Identify and give some examples of invasive species, characteristics and effects on livelihoods
2. Describe the management and control of Invasive species.

Key Points

- Understanding biology and spread – agents (animals, birds, people, tourism, agriculture inputs, water along roads) etc.
- Characteristics of invasive species and the environments they invade
- Effects of Invasive species
- Control techniques of Invasive species
- Use and benefits of Invasive species
- Other environmental ecosystem services by Invasive species

Resources Required

Pictures, photos and case studies of *Ipomoea, Prosopis juliflora* (Mesquite), *Acacia reficiens*, Prickly pear (*Opuntia ficus*) and *Lantana camara*

Reference Materials

Gichua, M., Njoroge, G., Shitanda, D. and Ward, D. (2013). Invasive species in East Africa: current status for informed policy decisions and management. Jagst, 15(1), 45–55. http://journals.jkuat.ac.ke/index.php/jagst/article/viewFile/1015/824

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Witt, A., Beale, T. and van Wilgen, B.W. (2018). An assessment of the distribution and potential ecological impacts of invasive alien plant species in eastern Africa. Transactions of the Royal Society of South Africa, 73(3), 217–236. https://doi.org/10.1080/0035919X. 2018.1529003

ICIPE. (2020). InternationalCentre for Inscect Physiology and Ecology. Strategy for managing invasive species in Africa. 2021-2030. ICIPE. http://www.icipe.org/system/files_force/ Strategy-for-Managing-Invasive-Species-in-Africa-20212030.pdf?download=1

SUB-MODULE 5: RANGELAND INFRASTRUCTURE

Introduction

Rangeland infrastructures are structures that enable communities in arid and semi-arid zones to provide for the wellbeing of livestock and support management of livestock. Some of this infrastructure includes those that help in containing livestock, infrastructure for market access, and those infrastructures for water systems. Examples include water infrastructure, dips and spray races, veterinary laboratories, Stock routes, holding grounds, Sale and auction yards, loading ramps and collecting yards, abattoirs and storage infrastructure. Having the right infrastructure at the right place is crucial in management of livestock and the environment.

Learning Objectives

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

1. List the various rangeland infrastructure
2. Understand the importance of infrastructure development in the rangelands
3. Understand the aspects of rangelands infrastructure
4. Discuss good practice and principles for water development of rangelands infrastructure
5. Enumerate key challenges that may arise from poorly planned infrastructure interventions
6. Describe key policies, strategies and regulations to be considered in development of infrastructure

Key Points

- Role of range infrastructure developments in livestock production
- Categories and examples of infrastructure
    - Water infrastructure (boreholes, water pans, subsurface dams and improved shallow wells
    - Livestock health, welfare infrastructure (Dips and spray races, veterinary laboratories, feed stores)
    - Market/physical infrastructure (Stock routes, holding grounds, Sale and auction yards, loading ramps and collecting yards, abattoirs etc.
- Challenges in rangeland infrastructure
- Policies and strategies for rangelands infrastructure
- Reference Materials

Reference Materials

MoLD. (2008). Ministry of Livestock Development. Session Paper No. 2 of 2008 on National Livestock Policy. 2, 1–53

Omondi, S.P.W., Kidali, J.A., Ogali, I., Mugambi, J.M. and Letoire Jacob. (2014) The status of livestock technologies and services in the Southern Maasai rangelands of Kenya. African Journal of Agricultural Research. 8. https://academicjournals.org/journal/AJAR/article-full-text-pdf/94B4F1443801

IUCN. (2022). Water for livestock. Promoting resilience by influencing development in community managed rangelands in Kenya. Accessed 02 Jan, 2022. http://www.ipm.iucn.org/content/water-livestock

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SECTION THREE: ALTERNATIVE LIVELIHOODS

This section covers six modules namely: Beekeeping/apiculture; Irrigated agriculture for horticultural high value crops; Aquaculture/fish farming, Doum palm; Acacia gum and Arabic resins and finally, rabbit TIMPs.

MODULE 1
BEEKEEPING (APICULTURE)

Introduction

The livelihoods of most people in rural Arid and Semi-Arid Lands (ASALs) of Kenya that covers over 80% of Kenya's land mass is endowed with a favourable environment and rich in biodiversity and is ideal for ***apiculture.*** This is also an area which supports a population of over 30%, which is mainly engaged in small-scale farming and is often vulnerable to food insecurity. The vulnerable and marginalised groups (VMGs) are greatly affected as they have no access to economic resources. Beekeeping has been identified as a viable agricultural enterprise that could alleviate poverty and sustain rural employment in the ASALs.

Beekeeping or apiculture is the art and science of keeping and managing the honey bee for the economic benefit of man. The honey bee, *Apis Mellifera* is a social bee that lives in large colonies of up to 100,000 bees. It is widely considered as one of the poverty alleviation strategies both by the Kenyan Government and other players supporting rural development in Kenya. Unlike other agricultural practices, beekeeping can be undertaken with minimal infrastructure, little capital and easy-to-learn skills hence providing an excellent opportunity for diversifying agricultural production.

Technologies, innovations and management practices (TIMPs) have been developed through research to address some of the challenges along the apiculture value chain. Adoption of the TIMPs is likely to increase honey production and consumption for improved nutrition and health. The TIMPs have been developed through research to address some of the challenges in the apiculture value chain.

Beekeeping has many benefits. These benefits that include; Source of food, source of incomes from hive products, i.e. Sale of honey, beeswax, royal jelly, pollen and propolis; Employment, Pollination services-the honey bee is a good pollinator, Medicine-hive products are good apitherapy products, and Conservation of biodiversity among others.

It is a flexible and potentially a socially inclusive enterprise that can be practised by the youth, women and the elderly. Beekeeping is a promising enterprise as there exists a huge demand for hive products with high potential for value addition. Despite its potential benefits, beekeeping faces a lot of challenges including Environmental degradation (forest cultivation, fires, charcoal burning etc.), Low adoption of improved technologies, Bee phobia, and increased use of agricultural chemicals among others.

List of Sub_modules

1. Sub-Module 1: siting Apiary and establishment
2. Sub-Module 2: Beekeeping equipment and accessories
3. Sub-Module 3: Colony and pest/predator management
4. Sub-module 4: Bee behaviour
5. Sub-Module 5: Bee forage /Bee plants
6. Sub-Module 6: Hive products
7. Sub-Module 7: Honey harvesting and processing
8. Sub-Module 8: Beekeeping Cost Benefit Analysis
9. Sub-Module 9: Value addition, Packaging and Market presentation.

Key Points

At the end of the module the learners should should have a thorough understanding of:

- Apiary siting and establishment involving right selection of hives and right methods of placement
- Beekeeping equipment and accessories including all types hives, harvesting, and processing equipment

- Colony and pest/predator management that leads to bee hygiene colonies and reduces infestation by pests and diseases
- Bee behaviour including coverage of bee castes and major bee practices like swarming, absconding
- Bee forage /Bee plants which helps identify major sources of nectar and pollen for bees
- Hive products, The main ones that are easily harvested honey, beeswax propolis and pollen
- Honey harvesting and processing with key identification of the top bar and traditional hive harvesting products and how each type is refined and by which equipment
- Beekeeping Cost Benefit Analysis on the profits that can be derived from beekeeping enterprises
- Value addition, Packaging and Market presentation. building into how various products can be made from hive products e,g candles creams, apitherapy products and how packaging can be improved for the market.

Reference Materials

Bradbear, N. (2009) Bees and their Role in Forest Livelihoods: A Guide to the Services Provided by Bees and the Sustainable Harvesting, Processing and Marketing of their Products, FAO, Rome, Italy.

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MODULE 2
AQUACULTURE-FISH FARMING

The term aquaculture broadly refers to the cultivation of aquatic organisms in controlled aquatic environments for any commercial, recreational or public purpose. It involves breeding, rearing and harvesting various forms of marine and freshwater life. Particular kinds of aquaculture include fish farming, shrimp farming, oyster farming, mariculture, pisciculture, alga-culture (such as seaweed farming), and the cultivation of ornamental fish marine organisms under controlled aquatic environments e.g. water tanks, cages, tanks, pods etc. it can involve the farming of two or more different organisms of different trophic levels where the wastes of one organism can be food for the other organisms and thus safeguarding the environment from wastes. There are four major aquaculture facilities? (i) freshwater pond culture; (ii) rice-fish culture or integrated fish farming; (iii) brackishwater finfish culture; (iv) mariculture involving extensive culture and producing fish/shellfish (e.g., oysters, mussels, cockles) which are sold in rural and urban markets at relatively low prices.

Fisheries and aquaculture provide essential nutrition, support livelihoods and contribute to national development. Aquaculture-fish farming offers farmers a land use diversification without big demand on land. The aquaculture fish farming has an important role to play in;

- Gender equality since iit can be practised by women and youth
- Poverty reduction as an income generating activity
- Food security where the fish is a nutritious food item in the community

Fish can be cultured in one of four culture Systems—ponds, raceways, recirculating systems or cages. A cage or net pen is a system that confines the fish or shellfish in a mesh enclosure.

Aquaculture farm facilities and their surroundings should be maintained in a clean and hygienic condition. Containers, equipment and farm facilities should be maintained in good condition for ease in cleaning and sanitising. Successful aquaculture takes into consideration the biology of the aquatic species such as feeding, water flow and temperature needs, and disease prevention and engineering design like water source and water quality study, pond and tank containment systems, water filtration and aeration. There are eight sub-modules covered in this module.

List of sub-modules:

1. Semi-Intensive Culture Systems and Management Practices
2. Intensive Culture Systems and Management Practices
3. Fish Breeding and Genetics
4. Fish Nutrition, Feed Formulation and Management Practices
5. Fish Health Management and Biosecurity
6. Fish Post-Harvest Technologies and Value Addition
7. Fish Marketing and Supply Chains
8. Aquaculture as a Business

SUB-MODULE 1: SEMI-INTENSIVE CULTURE SYSTEMS AND MANAGEMENT PRACTICES

Introduction

This sub-module discusses semi-intensive pond-based systems consisting of earthen, liner, concrete and wooden raised ponds. In Kenya, the bulk of aquaculture production is still by small-scale pond-based culture systems and practices. Aquaculture systems are categorised into three main categories depending on scale of production. The three categories are: (i) extensive systems with low degree of control; low initial costs, low-level technology, and low production efficiency; (ii) semi-intensive systems where supplemental feed is required to maintain higher stocking

rates; and (iii) intensive systems characterised by a high degree of control, high initial costs, high-level technology, and high production efficiency.

Learning Objectives

By the end of this sub-module, the trainees should be able to:

1. Demonstrate and explain site selection and validation of pond-based culture systems
2. Demonstrate and design pond-based culture Systems
3. Describe and explain BMPs in pond culture

Key Points

- Criteria for site selection and validation
- Selection of materials to be used
- Pond design and construction
- Challenges and solutions in site selection and survey

Reference Materials

Charo-Karisa H, Munguti J., Ouma H., Masai D.M., Opiyo M., Orina P.S & Okech J. K. (2011), Fish farmers manual, for beginner's students and hatchery managers, Kenya Marine & Fisheries Research Institute. River Brooks Communication Network Publishers, Nairobi Kenya

Lekang, O. I. (2020). Aquaculture engineering. John Wiley & Sons.

Ngugi, C. C., Bowman, J. R., and Omolo, B. (2007). A new guide to fish farming in Kenya.

Parker, R. (2011). Aquaculture science. Cengage learning.

Pillay, T. V. R., & Kutty, M. N. (2005). Aquaculture. Blackwell Publishers LTD

Smart Fish Project (2014). FAO Smart Fish Project Aquaculture Training Manual

SUB-MODULE 2: INTENSIVE CULTURE SYSTEMS AND MANAGEMENT PRACTICES

Introduction

The trainees in this sub-module will learn how to design, assemble and operate efficient, intensive culture systems such as recirculating aquaculture systems (RAS), raceway systems, cages and aquaponic systems. Different types of intensive culture systems and their associated designs, functions and operations will be highlighted. The sub-module emphasises on the design of low-cost small-scale aquaponics systems and highlights their associated challenges and lastly the use of Information and Communication Technology (ICT) in managing and operating these systems. The sub-module will further focus on Best Management Practices (BMPs) and their importance in increasing aquaculture productivity and conservation of natural ecosystems. Finally, the module addresses the key roles of fish farmers and other stakeholders in implementing BMPs.

Learning Objectives

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

1. Demonstrate understanding of operations, design culture systems, implement and operate simple and low technology cage, RAS and Aquaponics systems for running fish farms and hatcheries.
2. Apply knowledge and skills gained to increase productivity and food security using the cage, RAS and Aquaponic systems while keeping operating costs low.
3. Demonstrate use of intensive fish farming technologies/systems, their requirements and applications for increasing fish production.
4. Acquire skills for climate-smart technologies, innovations and best management practices in the aquaculture value chain.

Key Points

- Components and functions
- Installation
- Operations
- Site selection criteria - Suitability map for cage culture in both lakes and reservoirs
- Cage materials and components acquisition and assembly
- Cage design and construction - Low volume high density (LVHD) and High-density polyethylene (HDPE) cages
- Cage management - Feeds, seed, water quality, record keeping and disease prevention
- Challenges and solutions associated with cage farming.

Reference Materials

Parker, R. (2011). Aquaculture science. Cengage learning.

Engle, C. R. (2010). Aquaculture economics and financing: management and analysis. John Wiley & Sons.

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Egna, H. S., & Boyd, C. E. (1997). Dynamics of pond aquaculture. CRC press.

Lin, C. K., Shrestha, M. K., Yi, Y., & Diana, J. S. (2001). Management to minimize the environmental impacts of pond effluent: harvest draining techniques and effluent quality. Aqua cultural Engineering, 25(2), 125-135

SUB-MODULE 3: FISH BREEDING AND GENETICS

Introduction

In Kenya, there is a high demand for quality certified fish seed for improved aquaculture productivity. To enhance the production of quality seed, there are several documented fish breeding and genetics techniques available which include chromosomal manipulation, hybridization or cross-breeding, hormonal sex reversal, GIFT YY male technology, gene transfer and selective breeding. This sub-module explains the protocols to be used in fish breeding of commercially important fish species in Kenya namely Nile tilapia, African catfish, African carps (*Barbus spp*, *Labeo victorianus)*, and ornamental fish.

Learning Objectives

By the end of this sub- module, the trainees should understand:

1. Skills and knowledge in fish genetics and breeding of commercially important fish species
2. Skills and knowledge in commercially important wild fish stocks selection and domestication
3. Positive qualities for commercially important fish species to enhance production and market acceptability
4. Skills and knowledge in fish breeding techniques for increased yields
5. Knowledge in broodstock and fry/fingerling management
6. Skills and knowledge in broodstock genetic integrity and biosafety management
7. Benefits of fish breeding and genetics in aquaculture development.

Key Points

- Selective Breeding
- Sex determination
- Broodstock Management and feeding
- Types of spawning e.g. natural, semi- natural, semi-artificial and complete artificial propagation
- Hormonal Sex-reversal protocol YY technology
- Crossbreeding and hybridization
- Egg, fry and fingerling management
- Phenotypic identification of pure strains and crosses

- Factors contributing to genetic pollution of broodstock
- Genetic biosafety considerations in aquaculture

Reference Materials

Charo-Karisa H., Munguti J., Ouma H., Masai M.D., Opiyo M., Orina P. & Okechi J. (2011). A fish farmer's manual for beginners, students and hatchery managers. Kenya Marine and Fisheries Research Institute. River Brooks Communication Network Publishers, Nairobi-Kenya.

SmartFish-FAO (2014). Aquaculture Training Manual- Program for the implementation of a regional fisheries strategy for the Eastern and Southern Africa – Indian Ocean region. GCP/RAF/466/EC SmartFish Project.

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SUB-MODULE 4: FISH NUTRITION, FEED FORMULATION AND MANAGEMENT PRACTICES

Introduction

This sub-module specifies the training competencies needed to produce cost-effective cottage/supplementary and commercial pellet fish feeds. It involves the following: sourcing of especially locally available fish feed ingredients, feed formulations using the locally available feed ingredients, feed processing for the different fish species and growth stages, feeds conversion ratio, feeding strategies; the relationship between feeding and water quality in culture systems, and feed storage.

Learning Objectives

By the end of this sub-module the trainees should understand:

1. Skills on sourcing of quality feed ingredients
2. Knowledge on formulating highly quality feeds, targeting various species, the different developmental/ growth stages and different culture systems
3. Knowledge and skills in fish feed processing
4. Knowledge and skills on feed packaging and storage
5. Knowledge in adequate management of feeding and water quality in culture systems
6. Best management practices in fish feeds
7. Knowledge for monitoring growth and feed conversion ratio of different formulations.

Key Points

- Nutritional and physical characteristics of the feeds
- Nutrients requirements for the different fish species & growth stages - right quantities and proportions for good performance in terms of both growth and health
- Accessibility of nutrients within the feeds – bioavailability
- Effects of floating and sinking feeds
- Feeding schedules for different fish sizes/stages (Juvenile fish require higher protein in their feed than brooders)
- Feeding rates for different fish species
- Feeding methods (broadcasting, automated and demand-driven) and why?
- Administering the feed and feeding response
- When not to feed
- Factors to consider when feeding fish.

Reference Materials

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SUB-MODULE 5: FISH HEALTH MANAGEMENT AND BIOSECURITY

Introduction

The sub-module on fish health management and biosecurity specifies the training competencies required for fish health and biosecurity. It includes the practices, procedures and policies used to prevent the introduction of disease-causing organisms. The occurrence of disease outbreaks in fish farming may be due to poor husbandry practices since the disease- causing organisms are always in the environment. Diseases cause problems until the fish become stressed through inadequate dietary or environmental conditions. Since fish consumers would want to have an assurance that fish products are safe to eat, retailers have a responsibility of ensuring the quality and safety of fish for human consumption. The farm management needs to ensure that biosecurity principles are observed in all farm operations.

Learning Objectives

By the end of this sub-module, the trainees should understand:

1. Role of stress in disease development explained and understood
2. Common diseases and predators in aquaculture identified
3. Emerging diseases in aquaculture appreciated
4. Control measures for fish diseases, parasites, predator and pest control developed and shared
5. Important steps in biosecurity within a fish farm identified
6. Comprehensive biosecurity plan within an aquaculture facility developed and shared.

Key points

- The host-pathogen-environment relationship in stress development
- Sources of stress in aquaculture
- Good husbandry practices for management of stress in aquaculture.
- Maintenance of good water quality for reducing stress in aquaculture.
- Some common fish diseases and their prevention in aquaculture: parasitic, fungal, bacterial, viral diseases
- Emerging diseases in aquaculture and their prevention: TiLV
- Disease identification techniques
- Control of diseases and parasites: water quality management, good husbandry, sanitation, handling, nutrition, treatment
- Common predators in aquaculture
- Predators as hosts and vectors of disease agents and their role in parasite life cycles
- Controlling predators/ disease hosts in fish farms
- Biosecurity development process/steps and levels in aquaculture
- Documentation and record-keeping in aquaculture biosecurity
- Standards for biosecurity: construction, operation, disposal, disinfection, sanitation standards

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Noga E. (2010). Fish disease diagnosis and treatment. Wiley-Blackwell Publications.
Francis-Floyd. (2005). Introduction to fish health management. Fisheries and Aquatic Sciences Department, Florida Cooperative Extension Service. CIR921.
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aquaculture biosecurity requirements for preventing, controlling and eradicating infectious diseases. Journal of Applied Aquaculture, 27(3), 185-219.

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SUB-MODULE 6: FISH POST-HARVEST TECHNOLOGIES AND VALUE ADDITION

Introduction

This sub-module trains on specific competencies required for fish post- harvest and value addition. Value addition is about seizing opportunities offered by the market. It involves improving the quality of products, enhancing their value and in return better income. These two aspects (post-harvest and value addition) comprise several processes, including transportation and handling fish hygienically; processing fish using different value enhancing techniques; preparation of fish using different recipes; maintenance of good quality fish products; packaging, branding and certifying fish and fish products and preparation and storage of fish safely for longer shelf life. There are two possibilities of adding value: (1) value capturing through the improvement of current production, processing, trading processes to increase productivity, reduce wastage and reduce costs, and by entering new markets with existing products. (2) value creation through product innovation (e.g. new processed products).

Learning Objectives

By the end of this sub-module, the trainees should understand:

1. Skills in post-harvest handling of fish developed and shared
2. Knowledge and skills of personal hygiene in fish handling developed.
3. Skills on best management practices in fish preservation and value addition developed and shared.
4. Knowledge and practical skills in fish value addition shared.
5. Monitoring the quality and safety of fish value-added products shared
6. Practical skills in fish packaging and branding developed and shared

Key points

1. Importance of Good Fish Handling Practices,
2. Hygiene requirements for fish handlers Fish quality aspects
3. What fish quality is and its importance
4. Factors affecting fish quality in farmed fish
5. Apply the good product handling practices in their farms to reduce fish contamination
6. How to prevent Fish Contamination Environment
7. Handling Processes:
    - Sun drying
    - Smoking (Traditional and Modern)
    - Gutting
    - Chilling and freezing (principles of good icing practice)
    - Salting (types of salting)
    - Canning
    - Fermentation
    - Benefits and factors to consider in fish value addition
    - Quality standards
    - Cost-benefit analysis
        - Increased product shelf life
        - Better product prices
        - The increased product mix in the market
        - Product quality assurance
        - Product traceability
        - Easy and safe commodity handling

Reference Materials

SmartFish-FAO (2014). Aquaculture Training Manual- Program for the implementation of a regional fisheries strategy for the Eastern and Southern Africa – Indian Ocean region. GCP/RAF/466/EC SmartFish Project.

State Department of Fisheries (2015). Fish quality assurance guidelines for fish business operators in Kenya. Government Printer, Nairobi, Kenya

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Kyule-Muendo D., Munguti J.M, Opiyo M. A., Obiero K. O., Githukia C. M., Orina P.S., Njiru J.M.& Charo-Karisa H. (2017) Fish Recipe Book, Vol. 1, Kenya Marine and Fisheries Research Institute (KMFRI), Kenya Literature Bureau, Nairobi, Kenya. 45pp

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SUB-MODULE 7: FISH MARKETING AND SUPPLY CHAINS

Introduction

This sub-module provides trainers with skills that will enable them to assist aquaculture farmers to engage with markets using participatory methods. The sub-module guides on how fish and fish products can effectively be marketed; formulate costing and pricing charts; prepare marketing tools; project supply and demand curve in the market; advertise and promote fish and fish products; maximise profit margin from fish sales and market fish in groups or clusters. Furthermore, it will guide the process of market identification and selection of attractive enterprise options, based on information gathered from the market chain and analysis of local supply and demand trends and market access options.

Learning Objectives

By the end of this sub-module, the trainees should understand:

1. Fish markets and marketing appreciated and understood
2. Concepts such as costs, income, prices and profits applied and understood.
3. Concepts of basic market survey and analysis to determine the demand for specific products understood and shared.
4. Knowledge and skills on fish supply and demand and setting of marketing targets appreciated.
5. Assessing profitability of various marketing strategies understood.

Key points

- Types of value chain actors
- Marketing functions and services
- Marketing channels and distribution networks
- Virtual and physical market aggregators
- Marketing tools and applications
- Market analysis
- Market surveys tool (template of a basic questionnaire)
- Analyzing and presenting market information
- Development of group marketing strategies

Reference Materials

Charo-Karisa H, Munguti J., Ouma H., Masai D.M., Opiyo M., Orina P.S & Okech J.K. (2011). Fish farmers manual, for beginner's students and hatchery managers. KMFRI. River Brooks Communication Network Publishers, Nairobi Kenya

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LVFO. (2014). LVFO Aqua-Business Training Curriculum Notes. FAO TCP/ RAF/3102(A) Project

SmartFish-FAO. (2014). Aquaculture Training Manual- Program for the implementation of a regional fisheries strategy for the Eastern and Southern Africa – Indian Ocean region. GCP/RAF/466/EC SmartFish Project

SUB-MODULE 8: AQUACULTURE AS A BUSINESS

Introduction

In any economic activity regarding aquaculture as a business, new approaches focus on the understanding of aquaculture as a business. This understanding represents a significant shift in technical requirements. Whereas early aquaculture practices were focused on limiting factors that were biological and technical in nature (i.e. identifying species and disseminating the best technologies), it is now understood that the technology must be accompanied by effective capacity building in business and market planning. This sub-module addresses the following aspects:

- Forms of business
- Business management
- Financial planning
- Evaluation of the economic performance of aquaculture
- Cash flow analysis
- Budget analysis and financial statements
- Preparation of a business plan

Learning Objectives

By the end of this sub-module, the trainees should understand:

1. Information on fish farming as a business accessed and appreciated

2. Application of production skills and making profits in the fish farming business shared and appreciated
3. Need to keep business records for fish business shared and understood
4. Modern business skills and planning, record keeping formats in aquaculture smallholder farms shared and appreciated.

Key Points

- Factors considered in undertaking fish farming as a business
- Facilities needed by farmers to practice fish farming as a business
- Benefits of practising aquaculture as a profitable enterprise
- The short- and long-term goals in fish farming.
- Definition and importance of a business plan
- What it takes to develop a complete business plan
- Fundamental questions addressed by a business plan
- Evaluating and selecting suitable marketing alternatives
- Elements of an enterprise budget; uses of an enterprise budget
- The basic structure of an enterprise budget
- Principle and steps in partial budgeting
- Investment capital analysis e.g. payback period, net present value, internal rate of return
- Financial analysis in aquaculture e.g. profit income statement, solvency and liquidity
- Cash flow budget in an aquaculture enterprise

Reference Materials

Engle, C. R. (2010). Aquaculture economics and financing: management and analysis. John Wiley & Sons.

Pillay, T. V. R., & Kutty, M. N. (2005). Aquaculture. Blackwell Publishers.

MODULE 3
RESINS AND DOUM PALMS

This module has two sub-modules: Doum Palms and gums and resins value addition

SUB-MODULE 1: DOUM PALM VALUE ADDITION

Introduction

Doum palm (*Hyphaene compressa)* is one of the commonly available plants in several areas of northern Kenya and has potential to provide alternative livelihood options. The tree has economic, ecological, social and medicinal values for several communities. Some of the major products of Doum palm include baskets, sleeping mat, milk containers, brooms, ropes, hats and house thatch (makuti). The tree is also commonly used in traditional rituals and ceremonies among several pastoral communities. Doum palm further protects riverine ecology due to its confined growth suitability along the flood basins and tolerance to desiccation and livestock disturbance (Stave *et al.,* 2006). Because of the various uses, there is growing interest in Doum palm in different parts of the world.

Learning Objective:

By the end of this sub-module, the trainee should be able to:

1. Domesticate and maintain young doum palms
2. Harvest doum palm parts
3. Describe the uses and value addition of different parts of doum palm
4. Market doum palm products.

Key Points

- Distribution, domestication and maintenance of doum palm
- Protecting young doum palm parts
- Harvesting doum palm leaves
- Uses and value addition of different parts of doum palm
- Marketing of doum palm products
- Socio-cultural uses
- Economic uses

Reference Materials

Aremu, A.K. and Fadele, O.K. (2011). Study of some properties of doum palm fruit (Hyphaene the baica Mart.) in relation to moisture content; *African Journal of Agricultural Research Vol. 6*(15), pp. 3597-3602, 4 August, 2011; Available online at http://www.academicjournals.org/AJAR; DOI: 10.5897/AJAR11.247; ISSN 1991-637X ©2011 Academic Journals.

Hassan, Z.M.R., Aumara, I.E. (2005). Effect of Doum palm fruit Hyphaene thebaica on certain dairy starter cultures and undesirable microorganisms. *Annals of Agricultural Science. 50*:169-184. Research Article | Open Access.

Omire, A., Budambula, N.L.M., Neondo, J., Gituru, R. and Mweu, C. (2020). Phenotypic diversity of Doum palm *(Hyphaene compressa),* a semi-domesticated palm in the arid and semi-arid regions of Kenya; *Hindawi Scientifica* Volume 2020 |Article ID 4920830. Online at. https://doi.org/10.1155/2020/4920830

Orwa, C., Mutua, A., Kindt, R. Jamnadass, R. and Anthony, S. (2009). Agroforestree Database: a tree reference and selection guide version 4.0 (http://www.worldagroforestry.org/ sites/treedbs/treedatabases.asp

SUB-MODULE 2: GUM ARABIC AND RESINS VALUE ADDITION

Introduction

The collection of gums and resins illustrates how sustainable adaptation to climate change could potentially be

supported – it represents an alternative source of income for poor people during drought and as a non-wood forest resource it is likely to be environmentally sustainable. Strengthening the local adaptation options of pastoral communities requires recognition of the opportunities that the natural resources of dryland ecosystems provide for diversifying income sources. Plant gums, gum arabic and plant gum resins, myrrh, hagar and frankincense are among these natural resources. One advantage of these resources is their ability to produce in the dry season. Increased exploitation of indigenous gums and resins represents an opportunity to build adaptation on local knowledge, a key principle of sustainable adaptation; however, the exploitation of these resources comes with new challenges. This sub-module critically explores whether exploitation of gums and resins can contribute to sustainability in terms of both social equity and environmental integrity.

Learning Objectives

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

1. Understand tools and materials used in the collection of gum.
2. Enumerate gum production techniques.
3. Describe gum preparation and production.
4. Discuss methods of gum tapping and post-harvest handling.
5. Elaborate measures to ensure sustainable gum production.
6. Carry out value addition and marketing of gum.

Key Points

- Tools and materials used in collection of gum
- Enumeration of gum production technique
- Preparation of gum production
- Methods of gum tapping and post-harvest handling
- Measures to ensure sustainable gum production
- Value addition and marketing of gum

References Materials

Luvanda, A.M., Chikamai, B.N., Wambugu, S. and Macharia, N. (2016). Occurrence and distribution of *Commiphora holtziana* and *C. myrrha* in Wajir County, Kenya. *The International Journal of Science and Technology* (ISSN 2321 – 919X). www.theijst.com

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Wekesa, C., Luvanda, A.M., Muga, M.O., Chikamai, B.N. and Makenzi, P.M. (2013). Market chain analysis of gum arabic Trade in Kenya. *Octa Journal of Environmental Research April - June, 2013. International peer-reviewed journal I*SSN 2321-3655. Oct. Jour. Env. Res. Vol. 1(2): 93-106. Available online http://www.sciencebeingjournal.com

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MODULE 4
RABBIT PRODUCTION AND MANAGEMENT

Introduction

Rabbit farming in Kenya can be a very profitable agribusiness for anyone knowledgeable in animal husbandry. Unlike other livestock farming, rabbit farming requires a low capital investment to start up. Indeed, every part of the rabbit is useful. Its skin, which can be converted into leather, is much sought by shoe and bag making factories. Its fur is used for manufacturing clothes while bones go into the production of livestock feed. The rabbit's meat, of course, makes for a delicacy when properly cooked. Live rabbits on the other hand are used as specimens for tests in laboratories. Before venturing into the rabbit-breeding business, it is imperative to be well-grounded in the knowledge of the animals, how to raise them and which customers to approach for marketing.

List of Sub-Modules

- Housing
- Breeding and production
- Feeding and feeds
- Disease control
- Marketing and sales

SUB-MODULE 1: HOUSING

Introduction

Good rabbit housing for rabbit farming is very important. For commercial rabbit farming, build an enclosed building which has the proper management of ventilation, cooling, heating and lighting systems. Care should be taken about heating and ventilation systems because rabbits can't tolerate extreme chances of temperature. Thus, a pet playpen is the best enclosure for rabbits. Since a rabbit's cage is their home, where they will be living for most of the day, so sure that this is a safe place and comfortable for your rabbit. In the end, the cage you get should be 3 times the length of your rabbit and twice the width. This type of enclosure gives the rabbit more space, is cheaper, and securely keeps rabbit out of trouble.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Identify the materials required.
2. Describe the steps in rabbit house construction.
3. Explain the other important considerations in rabbit house construction.
4. Describe the benefits of rabbit farming.
5. Explain the constraints and challenges in rabbit farming.

Key Points

- Rabbits are sensitive to space and when not granted enough to freely move about, often exhibit abnormal behaviour
- Repetitive chewing of cage bars or over-grooming
- The rabbitry should be an enclosed construction with proper ventilation, lighting, heating, and cooling systems
- Rabbit population
- How the rabbits adapt to heat stress
- Factors affecting rabbit productivity

Reference Materials

Burn, C.C. and Shields, P. (2020). Do rabbits need each other? Effects of single versus paired housing on rabbit body temperature and behaviour in a UK shelter. *Animal Welfare 29*(2): 209-219. Doi: 10.7120/09627286.29.2.209

Clauss, M. and Hatt, J.M. (2017). Evidence-based rabbit housing and nutrition. *Veterinary Clinics: Exotic Animal Practice* 20(3): 871-884. doi: 10.1016/j.cvex.2017.04.006

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Valuska, A. and Mench, J. (2013). Size does matter: The effect of enclosure size on aggression and affiliation between female New Zealand White rabbits during mixing. *Applied Animal Behaviour Science 149*: 72–76. Doi: 10.1016/j.applanim.2013.10.002

SUB-MODULE 2: BREEDING AND PRODUCTION

Introduction

Rabbits have the potential to be one of the most profitable animal species to raise. They often give birth to large litters, and offspring grow fast and reach either market or breeding weight more quickly than any other species. There are many rabbit breeds. However, the white New Zealand rabbit breed is the most popular and highly productive commercial breed of rabbit. It has a great demand around the world. White New Zealand rabbit breed is an American creation which appeared after the red New Zealand rabbit. This species are highly productive on fur and meat.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Describe the good rabbit production and management practices.
2. Describe the three types of rabbit breeding.
3. Explain the application of genetics and physiology of reproduction to animal improvement.
4. Explain the importance of rabbit breeding in relation to agriculture.
5. Identify constraints and challenges in rabbit breeding and production.

Key Points

- Commencing rabbit farming in Kenya demands that you have a good understanding of the breeds
- Rabbits multiply rapidly and they start breeding at 4 to 5 months of age
- Classification of rabbits in Kenya
- Watering intervals

Reference Materials

Arteaga, L. (2008). Scent marking, dominance and serum testosterone levels in male domestic rabbits. *Physiology and Behaviour 94*: 510-515. Doi: 10.1016/j.physbeh. 2008.03.005

Bradbury and Dickens. (2016). Appropriate handling of pet rabbits: a literature review. *Journal of Small Animal Practice. 57*(10), 503-509. Doi: 10.1111/jsap.12549.

Mastellone, V. (2019). Mirrors improve rabbit natural behaviour in a free-range breeding system. *Animals, 9*(8), 533. Doi: 10.3390/ani9080533

Serem, J., Wanyoike, M., Gachuiri, C., Mailu, S., Gathumb, P.K., Mwanza, R.N., Kiarie, N. and Borter D.K. (2013).

Characterization of Rabbit Production Systems in Kenya; *Journal of Agricultural Science and Applications 2*(3) DOI: 10.14511/jasa.2013.020304

Thurston, S. and Ottesen, J.L. (2020). The rabbit. In: *Animal-centric Care and Management* 1st edition. CRC Press.

Turner, P.V. (2014). Rodent and rabbit welfare in the research environment. In: *Laboratory Animal Welfare* Academic Press.

SUB-MODULE 3: FEEDING AND FEEDS

Introduction

Rabbits should have a daily diet of mostly hay, a smaller amount of fresh vegetables, and a limited number of pellets. Hay is the most important part of a rabbit's daily intake. Unlimited, high-quality grass hay, such as Timothy, orchard or brome, should make up the bulk of a rabbit's diet. Thus rabbits feed on a variety of feeds such as: green feeds that include growing plants such as grasses and leafy vegetables; root crops such as sweet potatoes, turnips and beets; cereals grains namely oats, wheat, barley, grain sorghums, corn and rye and milled feeds such as bran, middlings and shorts. In general, Rabbits should eat twice a day; at noon, they should eat hay, combining it with vegetables, and for dinner, you can give them rabbit feed. Water is the most important – and probably the least expensive – nutrient your rabbits need. Water can help prevent some costly health problems.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Describe the good feeding and feed management practices under rabbitry enterprises.
2. Explain the different rabbit feeding regimes.
3. Describes the different rabbit feeding tools.
4. Describe the different rabbit feeds.
5. Explain the importance of feeds and feeding in rabbits.
6. Describe the constraints and challenges in rabbit feeds and feeding.

Key Points

- Nutrition-rabbits should be fed at least twice a day and provided with plenty of water
- marketing and sales
- The best food for them is grass, they can also be fed cabbage and lettuce
- Rabbits are naturally nocturnal creatures, preferring to eat at night
- Feed intake by rabbits
- Rabbit feeding tools
- Feeds and feeding constraints and challenges

Reference Materials

ACT online training (2017). How to pick up rabbits.

Bradbury and Dickens. (2016). Appropriate handling of pet rabbits: a literature review. *Journal of Small Animal Practice. 57*(10), 503-509. Doi: 10.1111/jsap.12549.

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SUB-MODULE 4: DISEASE CONTROL

Introduction

There are a number of infectious diseases in rabbits that include: Myxomatosis, caused by the myxoma virus and widely distributed in the wild rabbit population; Viral hemorrhagic disease; Encephalitozoonosis (Encephalitozoon cuniculi infection) and Pasteurellosis (Pasteurella multocida infection). Other common illnesses in rabbits are: Gastrointestinal (GI) Stasis; Dental Disease; Uterine Tumours; Head Tilt and Respiratory Tract Infections. Regular vaccination is the only way to ensure that your rabbits are protected from these diseases. It's important that you keep up to date with your pet's vaccinations schedule. Rabbit exams should be done at least annually, often twice a year in rabbits over 5 years of age.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Describe the good health management practices in rabbits.
2. Identify and describe the different diseases among rabbits.
3. Describe the prevention of the common diseases in rabbits.
4. Describe the integrated pest and disease management in rabbits.
5. Identify and explain the key constraints and challenges in rabbit disease control.

Key Points

- The most important factors for maintaining a healthy rabbit herd are cleanliness, good ventilation, close observation, and protection from sun and rain
- Rabbit manure handling
- Endeavour to prevent diseases
- Rabbits should receive regular vaccinations
- Integrated pest and disease management in rabbits
- Constraints and challenges in pests and disease control in rabbits

Reference Materials

Bradbury and Dickens. (2016). Appropriate handling of pet rabbits: a literature review. *Journal of Small Animal Practice. 57*(10), 503-509. Doi: 10.1111/jsap.12549.

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SUB-MODULE 5: MARKETING AND SALES

Introduction

Marketing is a crucial element that serves as the backbone of success when it comes to selling farm products and services. Regardless of how big or small one's operations are, one has the ability to find consistent clients to help one's business grow. Marketing prospects should be located and developed promptly when one engages in rabbit production. To make your rabbit enterprise financially successful, you must have a way to sell your animals. Your marketing methods and the price you receive may determine your ability to pay your expenses and make a profit. You might sell fryers live to commercial rabbit processors or to laboratory animal suppliers. Or, dress and sell the fryers to friends, relatives, neighbours, stores or restaurants. Each of these markets requires a clean, healthy, well-fleshed animal. Be sure to find out the county and state regulations governing the sale of dressed fryers. Rabbit products

can be sold to different markets such as: friends and family; farmer's markets; high-end or local restaurants; grocery stores; online (lots of extra red tape here since you may be selling across state lines); owners of dogs that consume raw dog food and commercial dog food companies.

Learning Objectives

By the end of this sub-module, the trainee should be able to:

1. Describe the good management practices in rabbit marketing and sales.
2. Explain a marketing strategy in rabbit production and marketing.
3. Describe the markets and marketing of rabbits and their products
   Explain the four "Ps" to consider when marketing your rabbit products and agribusiness.
4. Explain the process in rabbit products.
5. Describe the constraints and challenges in rabbit marketing and sales.

Key Points

- Not many people are involved in commercial rabbit production in Kenya
- Rabbit products supply is in high demand, it has been almost impossible for the few existing rabbit farmers to satisfy market demand
- Rabbit farming in Kenya can be a very profitable agribusiness for anyone knowledgeable in animal husbandry
- The 4 "Ps" in rabbit marketing and sales
- The rabbit production and marketing strategy
- Good rabbit marketing practices
- Constraints and challenges in rabbit marketing and sales.

Reference Materials

Bradbury and Dickens. (2016). Appropriate handling of pet rabbits: a literature review. *Journal of Small Animal Practice. 57*(10), 503-509. Doi: 10.1111/jsap.12549.

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SECTION FOUR: THE ENABLERS

Enablers are services and aspects that will facilitate implementation of interventions and realisation of the expected outputs. This section covers four modules and 28 sub-modules. The modules are: ICT (2 sub-modules); Cross-cutting issues (5 sub-modules); Agribusiness or farming as a business (8 sub-modules and Agricultural insurance (13 sub-modules).

MODULE 1

INFORMATION AND COMMUNICATION TECHNOLOGY FOR AGRICULTURAL ENTERPRISES

SUB-MODULE 1: ICT TOOLS FOR AGRICULTURAL PRODUCTION

Introduction

Information and Communications Technologies (ICT) refers to a diverse set of technological tools and resources used to create, transmit, store, and share or exchange information. The currently available ICT tools enable the collection of data, organisation, processing and analysis of the data into information. It is however important to understand that ICT tools are not deployed haphazardly without careful consideration of expected outcomes. All ICT systems are therefore driven by data which when well exploited provides evidence to guide informed decision-making and ultimately better outcomes.

Learning Objectives

By the end of this sub-module the trainee should be able to:

1) Define ICT
2) Explain the various clusters of agriculture-related ICT tools
3) Discuss the criteria for selecting ICT tools for Agricultural Production Value Chains

Key Points

- ICT refers to a diverse set of technological tools and resources used to create, transmit, store, and share or exchange information.
- ICT innovations can be clustered into tools: for agricultural production, market access services and financial Inclusion.
- The criteria for selecting ICT tools for enhancing agricultural production include: end user needs, functional stability, existing infrastructural support, affordability and simplicity, usability and maintenance capacity as well as scalability, replicability and viability.

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SUB-MODULE 2: ICT TOOLS THAT SUPPORT DECISION MAKING IN AGRICULTURE

Information and Communication Technology (ICT) supports farmers by facilitating access to markets through real-

time data on market prices; weather forecasts; information on pests; seed varieties and planting techniques. ICT in agriculture comprise those networks, mobiles, devices, services, and applications that aid the processing, management, and exchange of data, information, or knowledge with a target audience. They include a broad range of converging technologies, including traditional telecommunications, television and video, radio, cell phones and smart devices, and several modern technologies such as computers and the internet, sensors, Geographic Information Systems and satellites. Essentially, the purpose of ICT is to transfer information from one user/point to another.

All ICT systems are driven by data which when well exploited provides evidence to guide informed decision-making and ultimately enhance better outcomes. However, raw data has to be processed into useful information. Information when reliably collected is used in problem solving and disseminated as knowledge to support decision-making processes.

Learning Objectives

By the end of this sub-module the trainee should be able to:

1) Identify various decision support ICT tools for agriculture
2) Explain importance of each of the decision support ICT tool for agriculture
3) Access information from various decision support ICT tool for agriculture

Key Points

- KAMIS is a web platform that was developed to provide farmers and agricultural value chain stakeholders with improved early warning marketing and trade information.
- KAOP App uses geo-data from satellites to generate real-time and location specific agro-weather advisories to farmers and other stakeholders.
- eLocust3m App captures data about Desert Locust presence, bioecology and control operations.
- M-Farm links farmers with local buyers across the country.
- iCow App offers permanent access to highly credible and verified agricultural information and data in a reliable, cost-effective and simple design accessible through an SMS alerts subscription or access to specific farming needs on a 24-hour basis.
- Agrobase App provides a database with agronomic information on weeds, diseases and pests, including diverse pesticides, herbicides and pesticides details from the selected countries.
- VetAfrica App allows any farmer to record their livestock data in the process obtaining diagnostic guidance and advice on the most ideal treatment.
- Urban Farming App shows people living in urban centres and thinking about farming how to grow vegetables with ease through constant interactive reminders.
- Dairy Live App allows farmers to instantly access livestock information wherever they are on a computer or smartphone.
- Breeding Wheel App allows farmers to access individual animal data and images from a dairy herd in the form of a wheel.
- Kobo Collect and ODK Apps allow data collection, organisation and basic processing and visualisation.

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MODULE 2
CROSS-CUTTING ISSUES

Introduction

Cross-cutting issues are topics that are identified as important and that affect and cut across most or all aspects of development. These topics should therefore be integrated and mainstreamed throughout all stages of development from policy design, through implementation, to evaluation and learning. The key topics considered in this module of the guideline are; group dynamics, governance/leadership, gender, drug/substance abuse, disability and vulnerable marginalised groups (VMGs). This module covers seven sub-modules as follows:

List Of Sub-Modules

- Group Dynamics
- Governance/Leadership
- Gender and Gender Mainstreaming
- Drug/Substance Abuse
- Disability/ Vulnerable Marginalised Groups (VMGs)
- Agribusiness or farming as a business
- Agricultural Insurance

SUB-MODULE 1: GROUP DYNAMICS

Introduction

A group is a collection of individuals who have regular contact and frequent interaction, and who work together to achieve a common goal(s). In the context of farming, a farmer group is a collection of farmers with a common objective or problem to solve, which is often associated with the production and marketing of agricultural produce/ products. A group may consist of as few as two (2) people or as many as 300 or 400. There are two types of groups i.e. formal and informal. The formal groups are structured to pursue a specific task while the informal groups are those that emerge naturally in response to organisational or member interests. Group dynamics deals with the attitudes and behavioural patterns of a group. Group dynamics concern how groups are formed, what is their structure and which processes are followed in their functioning. Thus, it is concerned with the interactions and forces operating between groups. Group dynamics is relevant to groups of all kinds – both formal and informal. In an organisational setting, the term groups is very common, and the study of groups and group dynamics is an important area of study. A group formation passes through five stages; forming, storming, norming, performing and adjourning stages. A group has a number of benefits that include: (i). Groups of farmers can access services; (ii). Collective production, marketing and purchase of inputs; (iii). Farmer groups provide a forum to share experiences and learn from one another; (iv). Group pressure enhances or stimulates adoption of knowledge and change to improved practices; (v). Increases farmers' opportunities for participation in development programs; (vi). Gives farmers a 'voice', which they may use to influence policy and (vii). Attracts external support and easy access to loans (group guarantors).

Learning Objectives

By the end of this sub-module, the trainees should be able to:

1. Understand the meaning, characteristics and challenges of group dynamics
2. Appreciate the importance of group dynamics

Key Points

- A group is a collection of individuals who have regular contact and frequent interaction for a common goal.
- Group dynamics deals with the attitudes and behavioural patterns of a group.
- Group dynamics are about how groups are formed, what their structure is and which processes are involved.
- Livestock/crop farmer groups provide a forum to share experiences and learn from one another.

- Group pressure enhances/stimulates adoption of knowledge and change to improved practices.
- Group pressure increases farmers' opportunities for participation in development programs.

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SUB-MODULE 2: GOVERNANCE AND LEADERSHIP

Introduction

Leadership in governance is *the willingness and ability to take ownership in a part of an organisation and to continually do what is best for the organisation*. Leadership is about mapping out where you need to go to "win" as a team or an organisation; and it is dynamic, exciting, and inspiring. Yet, while leaders set the direction, they must also use *management skills* to guide their people to the right destination, in *a smooth and efficient way.* Leadership sets the direction and makes sure that it happens ... governance is the accountability for that.

Governance encompasses the system by which an organisation is controlled and operates, and the mechanisms by which it, and its people, are held to account. *Ethics, risk management, compliance and administration* are all elements of governance. The qualities of an effective team leader inspire the trust and respect of the team and stimulate production within the workplace. The qualities of a good governance or leadership include: (i). A clear communicator; (ii). Strong organisation skills; (iii). Confident in the team; (iv). Respectful to others/ Focuses on developing others; (v). Fair and kind; (vi). Influential in core areas; (vii). Willing to delegate; (viii). Self-aware and prioritise personal development; (ix). Encourages strategic thinking, innovation, and action and (x). Ethical and civic-minded.

Learning Objectives

By the end of this sub-module, the trainees should be able to:

1. Understand the meaning, characteristics and challenges of governance and leadership
2. Appreciate the importance of governance and leadership

Key Points

- Leadership is the willingness and ability to take ownership in a part of an organisation and to continually do what is best for the organisation.
- Leadership is about mapping out where you need to go to "win" as a team or an organisation; and it is dynamic, exciting, and inspiring.
- Governance encompasses the system by which an organisation is controlled and operates.
- It is the mechanism by which an organisation and its people are held to account.
- There are 10 qualities of good governance and leadership.

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SUB-MODULE 3: GENDER MAINSTREAMING

Introduction

Gender is defined as a social relationship between men, women, and youth that is determined by society. The relations refer to a complex system through which women, men, and youth socialise. These relations determine the role and access to power; access to resources and control over their use.

Gender mainstreaming means integrating a gender equality perspective at all stages and levels of policies, programmes and projects in terms of ownership, access and control of resources. Ownership defines to whom the resource belongs and makes decisions pertaining to; access is the opportunity to make use of a resource, control is the power to decide how a resource is used, and who has access to it.

Gender mainstreaming ensures that policy making and legislative work is of higher quality and has a greater relevance for society, because it makes policies responds more effectively to the needs of all citizens – women, men and youths (girls and boys).

Learning Objectives

By the end of this sub-module, the trainees should be able to:

1. Understand the meaning, characteristics and challenges of gender and gender mainstreaming
2. Appreciate the importance of gender and gender mainstreaming

Key Points

- The term gender is defined as a social relationship between men, women, and youth that is determined by society.
- The relations refer to a complex system through which women, men, and youth socialise.
- Gender mainstreaming is about integrating a gender equality perspective at all stages and levels of policies, programmes and projects.
- Gender mainstreaming ensures that policy making and legislative work is of higher quality and has a greater relevance for society.
- In selected agricultural value chains, men, women and youth perform various primary value chain functions, which include input supply, production, processing, storage, wholesale, retail and consumption.
- Integration of gender considerations into design and implementation of any agricultural project is a road to success.

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SUB-MODULE 4: DISABILITY & VULNERABLE MARGINALISED GROUPS (VMGS)

Introduction

Persons with disabilities (PWDs), according the UN Convention on the Rights of Persons with Disabilities, include those who have long-term physical, mental, intellectual or sensory impairments, which in interaction with various barriers may hinder their full and effective participation in society on an equal basis. The 2019 Kenya census

recorded 2.2% of the population above five years of age had a disability, whereas the 2009 census recorded 3.8%. In 2019 1.9% of men and 2.5% of women had a disability, while in 2009 3.7% of men and 3.9% of women had a disability. A disability is any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities (activity limitation) and interact with the world around them (participation restrictions). The PWDs are entitled to a barrier- free and disability- friendly environment to enable them to have access to buildings, roads and other social amenities, and assistive devices and other equipment to promote their mobility with disabilities in such manner as may be specified by the Council. The four major types of disabilities include physical, developmental, behavioural or emotional, and sensory impaired disorders.

Vulnerable and marginalized populations are groups and communities that experience discrimination and exclusion (social, political and economic) because of unequal power relationships across economic, political, social and cultural dimensions. Vulnerable populations include the economically disadvantaged, racial and ethnic minorities, the uninsured, low-income children, the elderly, the homeless, those with human immunodeficiency virus (HIV), and those with other chronic health conditions, including severe mental illness. Marginalised groups exist nearly everywhere. They are people who, for whatever reason, are denied involvement in mainstream economic, political, cultural and social activities. Marginalisation – sometimes also called social exclusion – refers to the relegation to the fringes of society due to a lack of access to rights, resources, and opportunities. It is a major cause of vulnerability, which refers to exposure to a range of possible harms, and being unable to deal with them adequately. It can negatively impact individuals' physical, psychological and emotional health. Some but not all of these consequences may include feelings of anger, anxiety, fear, depression, self-blame, sadness, stress and isolation.

Learning Objectives

By the end of this sub-module, the trainees should be able to:

1. Understand the meaning, characteristics and challenges of disability and VMGs in our society
2. Appreciate the importance and problems faced by disability and VMGs in our society

Key Points

- According to the UN Convention on the Rights of Persons with Disabilities, persons with disabilities (PWDs) include those who have long-term physical, mental, intellectual or sensory impairments.
- The PWDs are entitled to a barrier-free and disability-friendly environment.
- Vulnerable and marginalized populations are groups and communities that experience discrimination and exclusion.
- Marginalised groups exist nearly everywhere, and these are the people who, for whatever reason, are denied involvement in mainstream economic, political, cultural and social activities.
- Women, the elderly, adolescents, youth, and children, persons with disabilities, indigenous populations, refugees, migrants, and minorities experience the highest degree of socio-economic marginalisation.
- Marginalised people become even more vulnerable in emergencies.
- VMGs are a great issue worldwide and Kenya is no exemption.
- Disability is a global problem and in Kenya it is yet to be fully addressed by the government.

Reference Materials

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SUB-MODULE 5: DRUG/SUBSTANCE ABUSE

Introduction

Drug/substance abuse is increasing in Kenya and especially among the youth. Current statistics indicate that more than half of drug/substance users are aged 10-19 years. Most studies done in the country indicate that the commonly used drugs/substances are *nicotine, alcohol and cannabis.* The existing information shows that the most abused drugs/substance in Kenya are alcohol, and *Cannabis sativa* (bhang) which is grown in a few isolated parts of the country. But there are reports of somewhat isolated cases of; cocaine, mandrax, hallucinogens, amphetamines and solvents. Certain factors can affect the likelihood and speed of developing an addiction:

- Family history of addiction. Drug/substance addiction is more common in some families and likely involves genetic predisposition
- Mental health disorder
- Peer pressure
- Lack of family involvement
- Early use
- Taking a highly addictive drug

Learning Objectives

By the end of this sub-module, the trainees will be able to:

1. Understand the meaning, characteristics and challenges of drug/substance abuse in Kenya
2. Appreciate the importance and problems associated with drug/substance abuse in Kenya

Key Points

- Drug/substance abuse is on the increase in Kenya and especially among the youth.
- Drug/substance abuse is becoming a serious problem in Kenya
- Most studies done in the country indicate that the commonly used drugs are nicotine, alcohol and cannabis.
- Apart from the three common ones, there are reports of somewhat isolated cases of; cocaine, mandrax, hallucinogens, amphetamines and solvents.
- There are a number of factors that can affect the likelihood and speed of developing an addiction such as family history of addiction, mental health disorder, peer pressure and so forth.

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SUB-MODULE 6: AGRIBUSINESS-FARMING AS A BUSINESS

Investing in agriculture is an important strategy towards improving food and nutrition security; and rural incomes; reducing poverty; and promoting sustainable development. Financing agribusiness increases the added value of raw materials, strengthens rural economies and improves the quality of life in many vulnerable households. The majority of farmers in Kenya practice subsistence farming, producing both crops and livestock to meet their basic food requirements. The changing economic circumstances however dictate the need for additional finances to meet household demands and it is imperative that farmers deliberately engage in activities that generate income. Extension

services should support farmers to embrace 'farming as a business' approach to improve earnings from farm activities, and eventually transition from subsistence production to commercial/agribusiness. This calls for appreciation and application of business principles in day to day farming decisions and operations.

Agribusiness is a term used to describe the sector that encompasses all *economic activities* that are related to *farming*, i.e. inputs, breeding, livestock/crop production (farming), farm machinery, distribution, marketing and sales. Agribusiness refers to agriculture-related activities that put farmers, processors, distributors and consumers within a system that *produces, processes, transports, markets and distributes agricultural products*. Financing agribusiness can increase the added value of raw materials, strengthen local rural economies, food security and nutrition, and improve the quality of life in many homes at risk of exclusion and vulnerability.

Entrepreneurship/ agripreneur is the ability and readiness to develop, organise and run a business enterprise, along with any of its uncertainties to create value and make a profit. Entrepreneurship is viewed as change, generally entailing risk beyond what is normally encountered in starting a business, which may include other values than simply economic ones.

Farming for the market is a business; (i). It is a business because farmers use land, labour, and capital (factors of production) to produce goods to be sold, (ii). Such farming is done in the hope and expectation of profit as in all other businesses.

This sub-module covers the following topics: (a). Crucial Business Principles; (b). Importance of Agribusiness; (c). Farm Business Planning; (d). Farm Business Budgeting; (e). Farm Records and Record Keeping; (f). Farm Accounting; (g). Gross Margin and (h). Markets and Marketing.

Learning Objectives

By the end of this sub-module, the trainees will be able to:

1. Understand the meaning of Agribusiness (FAB)
2. Describe operation of a farm with profit making as the main objective i.e. operating a farm as a business enterprise.
3. Appreciate the importance of farmers adopting FAB
4. Explain FAB provides food for a family, a profit for improved living standards and or future investment
5. Comprehend the requirements of a successful agribusiness
6. Explain capacity building the farmer (trainings, exposure tours)
7. Describe record keeping; market oriented farming (market surveys)
8. Describe provision of market information and ;linkage to markets
9. Describe business planning; credit facilities and gross margins.

Key Points

- Importance of Agribusiness
  - Message: *Doing agribusiness means not only producing for subsistence but for a surplus to generate HH income*
- Farm Business Planning:
  - Message: *It helps the farmer/ entrepreneur make the best use of his/ her meagre resources*
- Farm Business Budgeting
  - Message: *Available resources are limited/ meagre – appropriate resource allocation*
- Farm Records and Record Keeping
- Message: Helps in decision-making – What, how much, when to, and why produce; Shows direction a business is heading to

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SUB-MODULE 7: AGRICULTURAL INSURANCE

Risk is an important aspect of the farming business and arise from a variety of sources. Farming businesses operate in a rapidly changing and unpredictable environment that impacts upon the outcomes of investment activities. The uncertainty associated with climate variability is a disincentive to investment, adoption of agricultural technologies and response to market opportunities. Farmers face a number of interconnected risks. Risk can be defined as the probability of occurrence of hazards and shocks that negatively impact agricultural production, trade, markets and consumption. Weather index insurance is one of the possible interventions for overcoming the negative impacts of climate risk on rural livelihoods and agricultural production. Index insurance is normally linked to rainfall anomalies (drought, floods), extreme temperatures and humidity (frosts, hails), or even livestock/ crop yields. The use of a weather index linked to an insurance mechanism is a market-driven solution. It calls for a public-private partnership and the development of the private sector for its success. Climate risk insurance for developing countries aims at reducing the economic risks of people. Insurance can buffer at least the financial implications of extreme weather and climate events through its risk transfer role. Currently, most public private programmes in developing countries offer livestock and crop insurance. Insurance spreads and smoothens risks allowing farmers to recover faster and more efficiently.

Insurance companies understand that livestock forms an important part of farmers' income generating activities. They offer insurance cover for high value animals (dairy or beef) losses/death as a result of; accidents, illness and disease, epidemics, emergency slaughter and calving risks. The companies cover farmers' cattle; dairy and beef from the age of 3 months to 10 years; and sheep and goats from the age of 2 months to 7 years. The insurance can be extended to cover; transit risks, theft cover as well as loss of income benefit. Livestock insurance covers against losses to animals. While these policies are usually meant for standard farm animals like horses, poultry, and cattle, they can also cover losses of exotic and aquatic animals.

Learning Objectives

1. Create a common understanding on agricultural insurance TIMPS
2. Understand the features of livestock insurance cover
   - Risk financing and management
   - Sources of agricultural risks
   - Types of agricultural insurance
   - Insurance products
3. Appreciate the benefits of Livestock insurance

Key Points

- The ongoing risk of climate change (CC) is one of the many challenges facing Kenya's farmers' today.
- Insurance-related instruments can support the protection and promotion of sustainable development and human rights.
- Careful implementation and management through a comprehensive risk management and risk reduction strategy is needed
- Initiatives are needed to create a conducive enabling environment which encourages innovation, investment, and action.
- The right policies and incentives need to be in place so that the challenges imposed by CC on food

systems can be addressed

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