



Ministry of Agriculture and Livestock Development  
State Department for Crop Development  
P.O Box 30028, Nairobi



Emergency Locust Response Program  
P.O Box 30028,  
Nairobi



Kenya Agricultural & Livestock Research Organisation  
P.O Box 57811- 00200,  
Nairobi



The World Bank  
P.O Box 30577-00100  
Nairobi

## Sustainable Agricultural Livelihood Restoration, Rehabilitation and Resilience in Kenya

### Training Manual

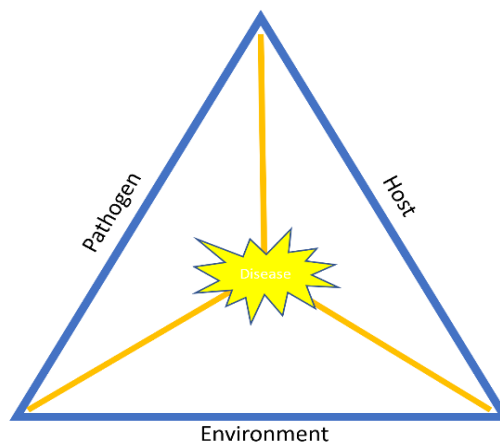
#### 2.3.3 SUB-MODULE 3: INTEGRATED PEST AND DISEASE MANAGEMENT (IPDM)

##### Introduction

A pest is any organism that competes in any manner, causes injuries and or spreads diseases to the desired plants compromising on the growth and development

Integrated Pest Management (IPM) is a pest management strategy that uses all the available pest management techniques considering all potential pests of a crop, where pesticides are only applied when it is absolutely necessary (when pest populations are above economic threshold). To be the introductory part, insert just before the principles of IPM

The objective of IPM is to optimize the combined effects of actions associated with the control methods e.g. host resistance, pathogen virulence and environment. For a disease to occur in crops, there must be a susceptible host plant, disease causing pathogen, and the conducive environment for the pathogen to interact with the host plant (e.g long durations of free water on a susceptible plant can increase pathogen infections and disease severity) as demonstrated in the disease triangle below .



Disease triangle- a conception model for interaction between the host, pathogen and environment in disease manifestation

##### Principles of IPM

IPM is made up of six principles that make pest management sustainable, they include:

- **Prevention:** This includes practices that prevent the entry and establishment of a pest into a crop area. It includes practices such as field sanitation, and planting certified seeds.



Ministry of Agriculture and Livestock Development  
State Department for Crop Development  
P.O Box 30028, Nairobi



Emergency Locust Response Program  
P.O Box 30028,  
Nairobi



Kenya Agricultural & Livestock Research Organisation  
P.O Box 57811- 00200,  
Nairobi



The World Bank  
P.O Box 30577-00100  
Nairobi

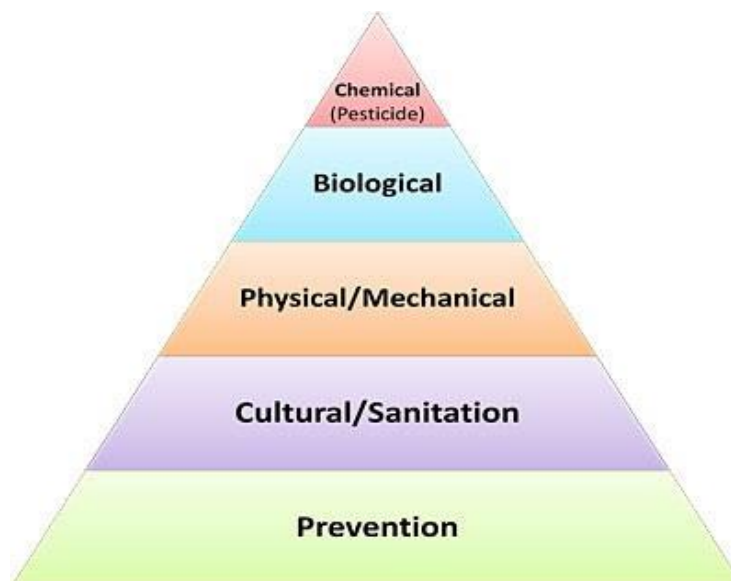
## Sustainable Agricultural Livelihood Restoration, Rehabilitation and Resilience in Kenya

### Training Manual

- **Identification:** Pests their hosts and natural enemies should be identified before any action is taken.
- **Monitoring:** Monitoring guidelines should be established to ascertain what pests are present and at what populations. scouting regularly for pests and diseases is recommended.
- **Action Thresholds:** action thresholds for different pests in different crops should be established to prevent economic injury especially in high value crops.
- **Implement Control tactics:** once the action thresholds have been established the different control tactics can be utilised in the management of the pest or disease.
- **Monitor evaluate and document the results:** the results of the management and or control tactic should be documented to evaluate its efficacy and the improvement practices and tactics that can be employed.

### The Concept of IPM

A holistic 'approach' or 'strategy' to combat plant pests and diseases using all available methods, while minimizing applications of chemical pesticides



IPM Pyramid

Benefits of IPM insert after the chemical method explanations

- Reduces environmental risks associated with pest management and protects non-target



Ministry of Agriculture and Livestock Development  
State Department for Crop Development  
P.O Box 30028, Nairobi



Emergency Locust Response Program  
P.O Box 30028,  
Nairobi



Kenya Agricultural & Livestock Research Organisation  
P.O Box 57811- 00200,  
Nairobi



The World Bank  
P.O Box 30577-00100  
Nairobi

## Sustainable Agricultural Livelihood Restoration, Rehabilitation and Resilience in Kenya

### Training Manual

species.

- Promotes production of quality and safe food
- Early detection of potential problems as a result of regular crop monitoring.
- Development of a robust cropping system

### Designing an IPM Program

When designing an IPM program one needs to ask and answer the following questions:

- What do I know about the pest/s?
- Where am I getting the problem from?
- What practice/s increase or reduce pest on my farm?
- What are the control measures at my disposal?
- What can I do about my planting materials?
- How can I improve biodiversity on my farm?

The major components of IPM in increasing order of complexity are as follows;

**Cultural methods.** Cultural methods include regular farm operations that either destroy pests or prevent them from causing economic loss. this includes but is not limited to:

- Planting certified seeds
- Roguing infected plants
- Intercropping to improve plant nutrition
- Crop rotation
- Early harvesting
- Early planting

Mechanical/ Physical methods including:

- Removal and destruction of egg masses, larvae, pupa and adults of insect pests and diseased plant parts whenever possible
- Use of insect traps
- Flooding
- Use of pheromones to disrupt mating and for mass trapping
- Use of forceful irrigation water to dislodge insects

**Regulatory Practices.** These are practices that are enforced by a government regulatory body such as KEPHIS (in the kenyan context), under which seeds and infested plant materials are not allowed to enter the country or from one part to other parts of the country. These are known as quarantine methods and are of two types i.e. domestic and foreign quarantine.



Ministry of Agriculture and Livestock Development  
State Department for Crop Development  
P.O Box 30028, Nairobi



Emergency Locust Response Program  
P.O Box 30028,  
Nairobi



Kenya Agricultural & Livestock Research Organisation  
P.O Box 57811- 00200,  
Nairobi



The World Bank  
P.O Box 30577-00100  
Nairobi

## Sustainable Agricultural Livelihood Restoration, Rehabilitation and Resilience in Kenya

### Training Manual

**Biological Methods.** Biological methods involve the use of living organisms to control unwanted organisms. Biological pest and disease control is based on the principle that all living organisms have a natural predator that keeps their populations in check. Organisms used in biological control include:

- **Parasitoids-** organisms that lay eggs on the bodies of their hosts, when the eggs hatch they kill the host for example parasitic wasps in the control of aphids.
- **Predators-** these are free living organisms that prey on other organisms for food and examples include dragonflies, spiders and lady bird beetles.
- **Biopesticides-** these are microorganisms that infest the host causing diseases and eventually killing the host. Pathogens used as biopesticides include fungi, viruses, bacteria and some nematodes. Examples of biopesticides commonly used include *Beauveria bassiana* in the control of termites and whiteflies, *Metarhizium anisopliae* used in the control of larval stages of insect pest, *Trichoderma spp* used in the control of soil pathogens.

There are three practices that are used to introduce organisms into an environment under the biological control method:

- **Introduction-** The bioagent is introduced into a locality for its establishment against its host
- **Augmentation-** the population of the already present natural enemies in the environment is enhanced by releasing laboratory reared or field collected agents in numbers that would suppress the pest or disease
- **Conservation-** the natural enemies within the environment are protected from being killed through practices like not spraying broad spectrum chemicals that could reduce their populations

**Chemical Methods.** In IPM use of chemicals is considered as the last resort when all other methods of pest management have failed to keep the pest populations below economic threshold levels. Use of pesticides should be need based, judicious, based on pest surveillance to minimise not only the cost involved, but also reduce associated problems. While going for chemical control, we must understand thoroughly what to spray, when to spray, where to spray and how to spray.