

African Organic Agriculture Manual Booklet Series  
No. 8 | Pest and Disease Management

# HOW CAN I MANAGE PESTS AND DISEASES NATURALLY?

# What do I need to know?

**It is important to know** which pathogens create damage in the fields. Proper determination of the pathogen is the first step to effective pest and disease management.

Farmers consider organisms which reduce their crop yields as pests and diseases. Insects, birds or other animals are considered as pests, whenever they cause damage to crops or to stored produce. Fungi, bacteria and viruses are recognized as diseases, when they interrupt or modify the vital functions of growing plants or stored produce. But basically, all organisms are part of nature, irrespective of what they do, and deserve our respect.

**Pest damage** on crops is commonly caused by insects, mites, nematodes and mammals.

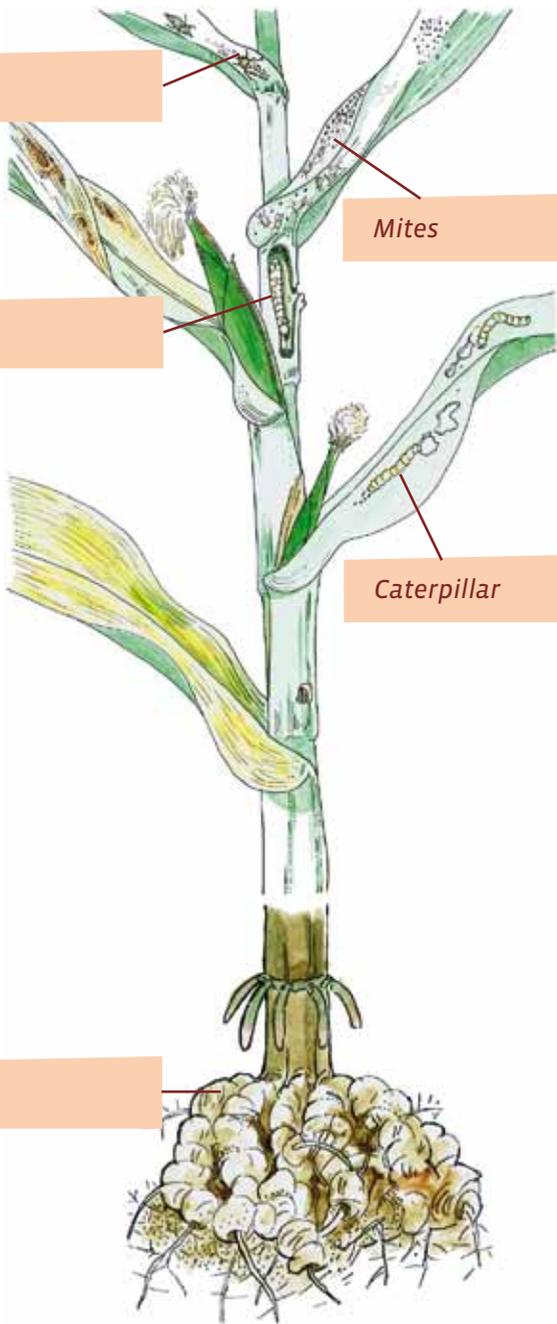
**Insect** damage is usually easy to identify: Leaves with holes or missing parts are damage caused by caterpillars or weevils; curled leaves are the result of aphids sucking sap; damaged or rotten fruit are common after being eaten by larvae of fruit flies; withering plants can also be caused by larvae of noctuids or stem borer; and branches or trunks with holes may be the result of an attack by wood-eating insects.

**Mites** are very small and cannot be seen with the naked eye. Spider mites, however, weave a typical tissue on attacked plant parts that is easily detected. Infested plants, leaves and fruit turn yellowish.

**Nematodes** are also very small and are not easily observed by the naked eye. Nematodes mostly attack plant roots resulting in yellowish plants that wither and die.

**Mammals** like elephants, monkeys or voles, and birds like sparrows, starlings and crows can also damage crops.

**Do you know**, which pests cause damage in your fields? What kind of damage is caused by insects, mites, nematodes and mammals?



*Aphids*

*Mites*

*Stem borer*

*Caterpillar*

*Nematodes*



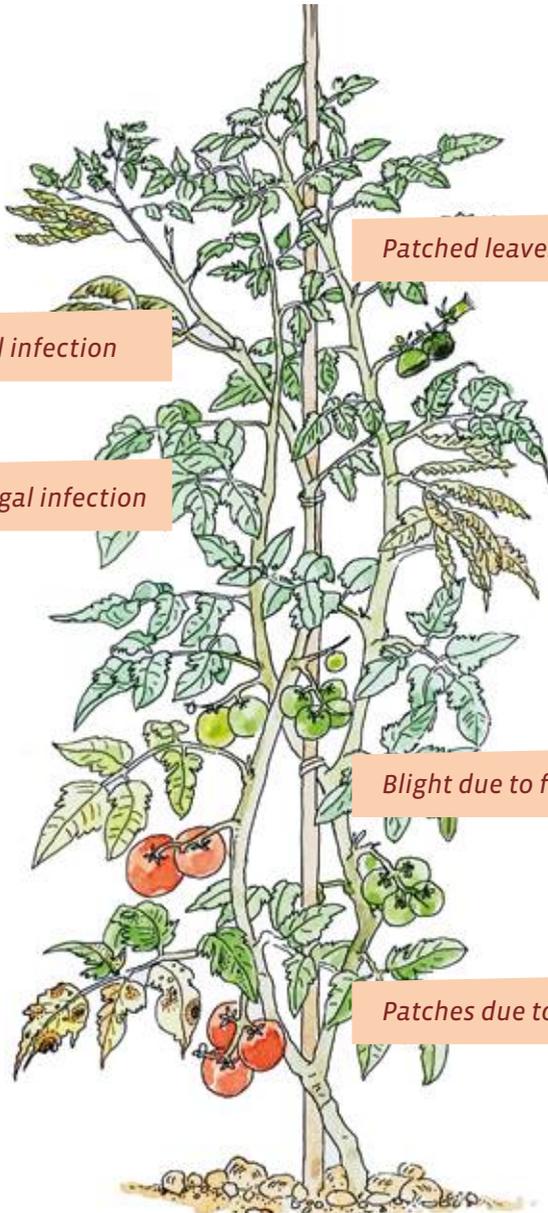
Most **crop diseases** are caused by fungi, bacteria or viruses.

**Fungi** cause the great majority of infectious plant diseases. They are responsible for most cases of spotting, cankering, blighting, wilting, scabbing and rotting on different plant parts. Fungi can cause parts of plants or the entire plant to wither and die.

**Bacterial infections** result in the breakdown of the cell walls of plants, so that the plant starts to rot. Damaged plant tissue or the blocking of water uptake causes early death of the plant, and overgrowth of plant tissue causes tumours.

**Viruses** mostly cause leaves and other green plant parts to change in colour. Light green or yellow patches of various shades, shapes and sizes appear in affected leaves resulting in a general reduction in the growth and vigour of the plant.

**Do you know, which pathogens cause diseases on your crops? What kind of damage is caused by fungi, bacteria and viruses?**



*Patched leaves due to virus attack*

*Rotting due to fungal infection*

*Withering due to fungal infection*

*Blight due to fungal infection*

*Patches due to bacterial infection*



Before managing any particular pest or disease, you should know, how it behaves in relation to the concerned crop. Monitoring improves your knowledge on pest and disease development and helps you to manage them more effectively. The following questions may help you to better understand pest and disease behaviour.



#### **Pest behaviour:**

- › At what stage of its lifecycle is the pathogen a pest: when it is a larva, a caterpillar or an adult?
- › Which stage of the plant does it attack: the seedling, the growing plant or the mature plant?
- › Which part of the plant does it attack: leaves, roots, the stem, fruits, seeds or the entire plant?
- › What kind of damage does it cause: chewing, sucking or wilting?
- › When does it attack: in the dry season or in the wet season?

#### **Disease behaviour:**

- › What is the cause of the disease: is it a virus, a bacterium or a fungus?
- › How is it transmitted: by seeds, through the soil, through the air, or through insects?
- › Which stage of the plant does it attack: the seedling, the growing plant or the mature plant?
- › Which part of the plant is infested: leaves, roots, the stem, fruits, seeds or the entire plant?
- › What kind of damage does it cause: rotting, chlorosis, wilting, spotting or other?
- › When does it attack: in the dry season or in the wet season?

**Do you regularly monitor pests and diseases in your crops?** Walk along a zigzag route through the field and collect random plant samples for analysis.

# How best to manage pests and diseases?

**There are different ways** of managing pests and diseases in the fields. The differences may not be obvious at first sight. It may take a closer look to see the differences between the approaches.

One way of managing pests and diseases is to fully rely on pesticides. This procedure may prove efficient if the choice of the pesticide, its dosage, the timing of the application and the application mode are correct.

But as a farmer you may not have access to synthetic pesticides. Or the pesticides may not be affordable to you. Pesticides also hold some risks during storage and application. The impact of application may be high in the short term. But over an entire cropping period it may be null, because the pesticide killed the natural enemies too and thus encouraged unhindered re-development of the pest. Even natural pesticides such as pyrethrum, derris or tobacco, and oils can have negative effects on beneficial insects. Pesticides can also lose efficiency, if the application of the substance is not regulated and pests develop resistance.

## **A sustainable approach to pest and disease management**

Instead of relying on pesticides mainly you may prefer an approach that

- > requires minimal extra cost only;
- > is easy to prepare and apply;
- > is effective under local conditions;
- > is safe to handle and
- > has minimal or no negative effect on other organisms, on water, soil, air and agricultural products.

**Which risks** do your pesticides bear at storage and application? Which effects do they have on natural enemies, natural resources and product quality?

# Organic pest and disease management

**Organic pest and disease management** relies on proper application of multiple preventive measures to minimize the need for direct control.

## A three step approach

Organic pest and disease management can be seen as a three-step approach, whereby each step builds the foundation for the next one.

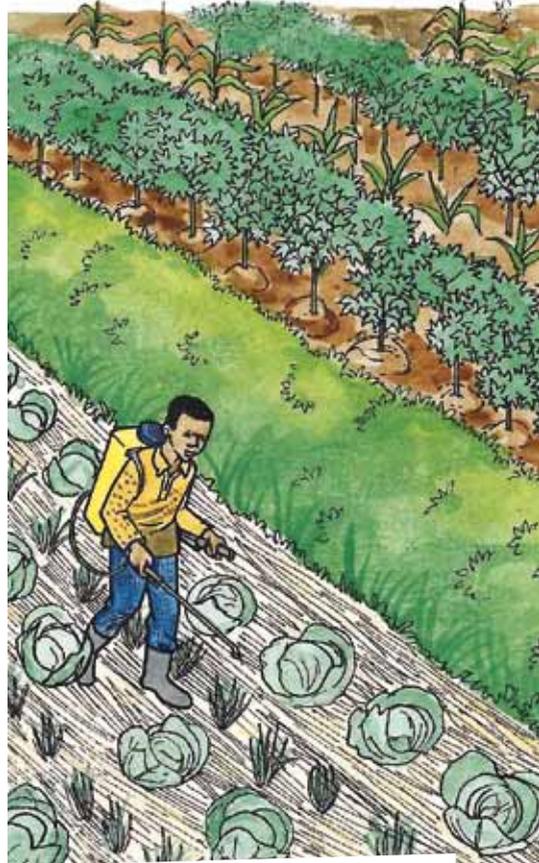
**Step 1:** Soil and crop management

**Step 2:** Habitat management

**Step 3:** Direct control

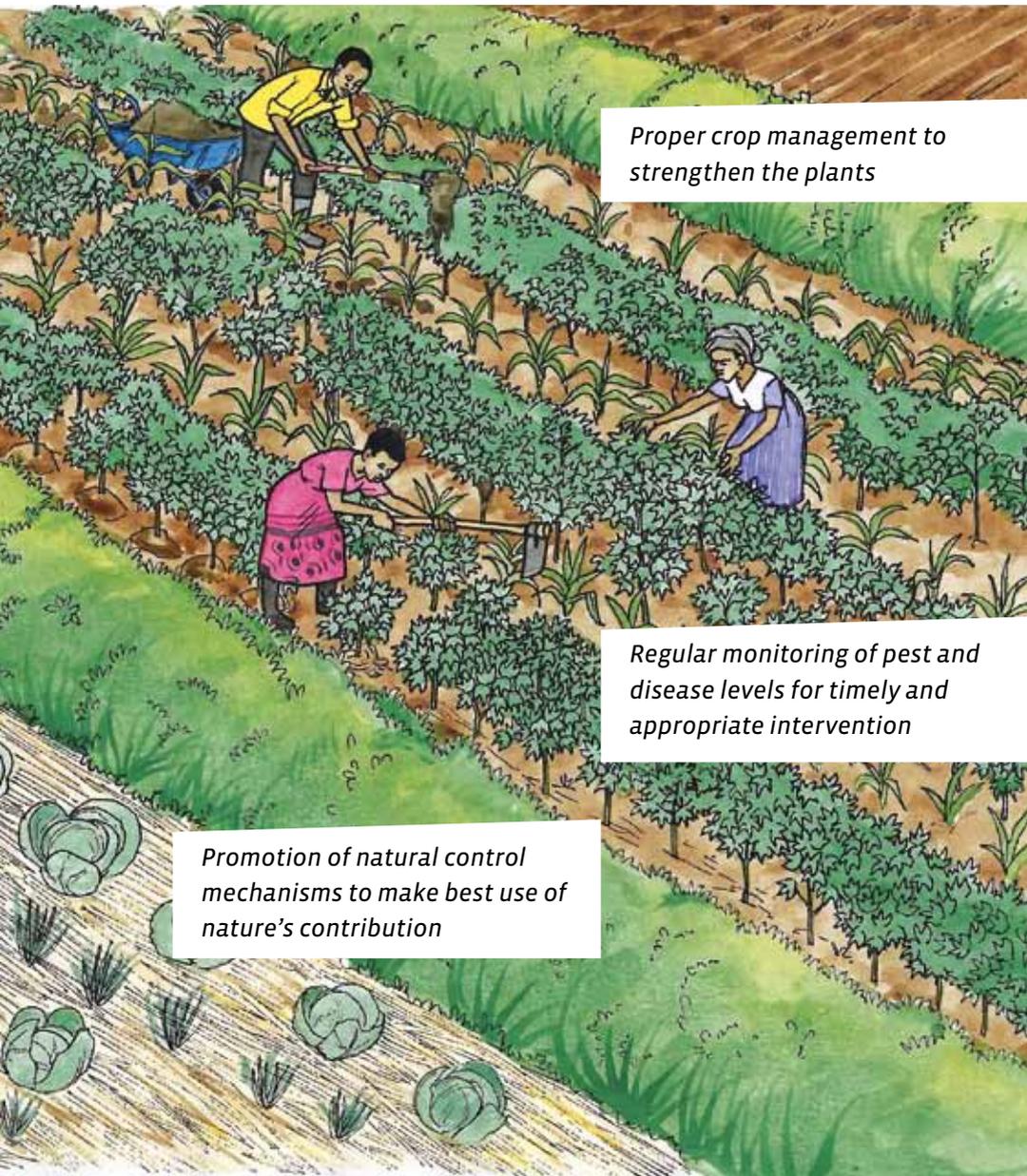
The aim is to optimize the 1<sup>st</sup> and 2<sup>nd</sup> step practices that encourage natural self-control of pest and disease pathogens, and to minimize the direct control measures.

Organic farmers put a lot of attention into prevention of spreading and multiplication of pests and diseases through proper crop management. This helps them to minimize costly direct control measures.



*Control measures with minimal negative impact on nature and natural enemies*





*Proper crop management to strengthen the plants*

*Regular monitoring of pest and disease levels for timely and appropriate intervention*

*Promotion of natural control mechanisms to make best use of nature's contribution*

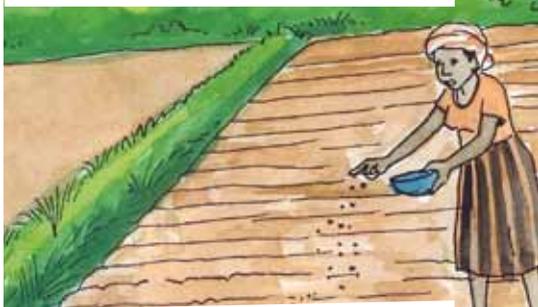
# 1<sup>st</sup> step: soil and crop management

## Proper soil and crop management

In a first step organic farmers aim at enhancing plant health and preventing introduction and spread of pests and diseases. They do it by applying multiple practices such as:

- › continuously improving soil fertility to encourage strong and vigorous growth of the plants;
- › ensuring proper soil preparation to promote rapid development of the crop;
- › choosing cultivars that are tolerant or resistant to the prevalent pests and diseases, and do well under local conditions;
- › using disease and pest free planting materials to avoid introduction of new pests and diseases to the field;
- › maintaining a planned crop rotation to limit build-up of pests and soil-borne diseases;
- › ensuring timely planting and growing different crops simultaneously to reduce coincidence of the crop with pests and diseases;
- › applying good crop management including pruning, shade management and timely harvesting to hinder development of pests and diseases.

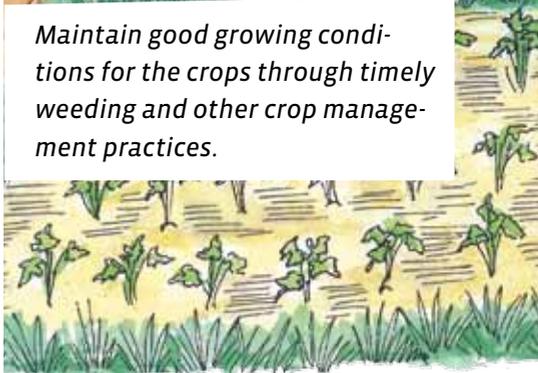
*Prepare the soil in a way to encourage good crop establishment.*



*Ensure timely sowing and planting for timely harvest.*



*Maintain good growing conditions for the crops through timely weeding and other crop management practices.*

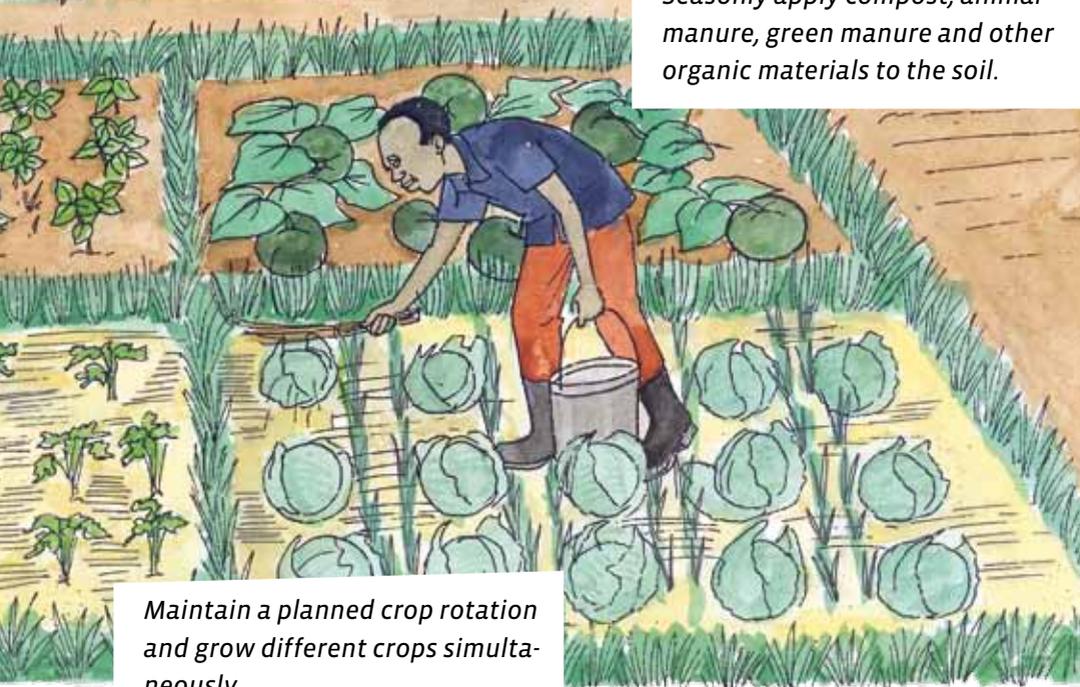




*Select robust cultivars and use healthy planting materials only.*



*Seasonally apply compost, animal manure, green manure and other organic materials to the soil.*



*Maintain a planned crop rotation and grow different crops simultaneously.*

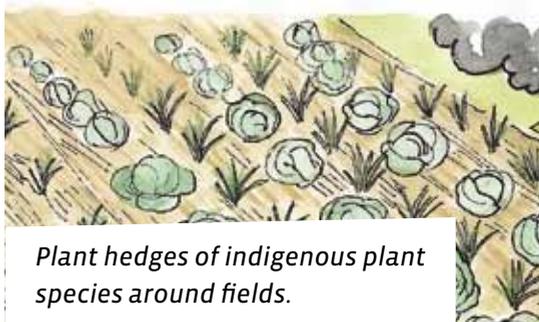
## 2<sup>nd</sup> step: habitat management

### Promotion of natural control mechanisms

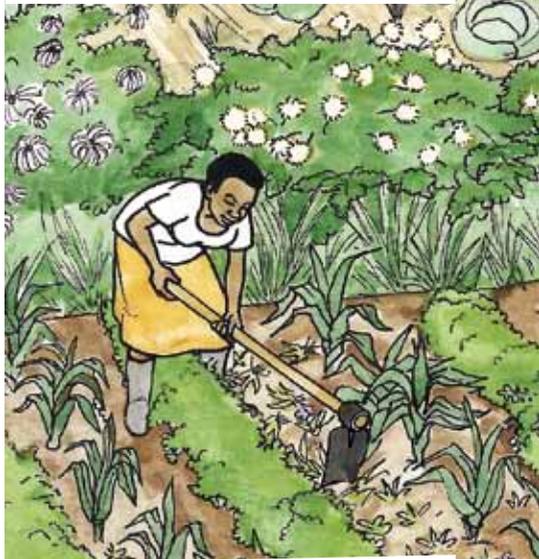
Pest and disease pathogens have natural enemies such as ladybird beetles, parasitoids or birds. Even viruses, bacteria and fungi can kill or compete with pest and disease pathogens. These natural enemies can be considered a farmer's friend.

Natural enemies can be enhanced around and within the crop fields by:

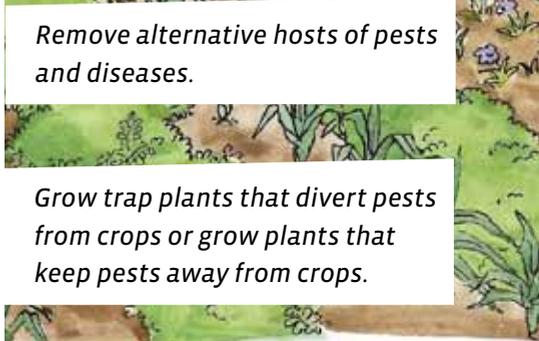
- › planting hedges of indigenous plant species around fields to attract natural enemies;
- › allowing flowering plant species to grow within crops to provide nectar and pollen for natural enemies such as ladybird beetles, hoverflies and parasitoids;
- › making use of trap cropping to attract pests to non-crops or push away pests from the crops (push and pull strategies);
- › improving field hygiene by timely weeding to remove alternative hosts, by destroying or proper disposal of infected plants and plant parts and by disinfecting tools used on infected plants.



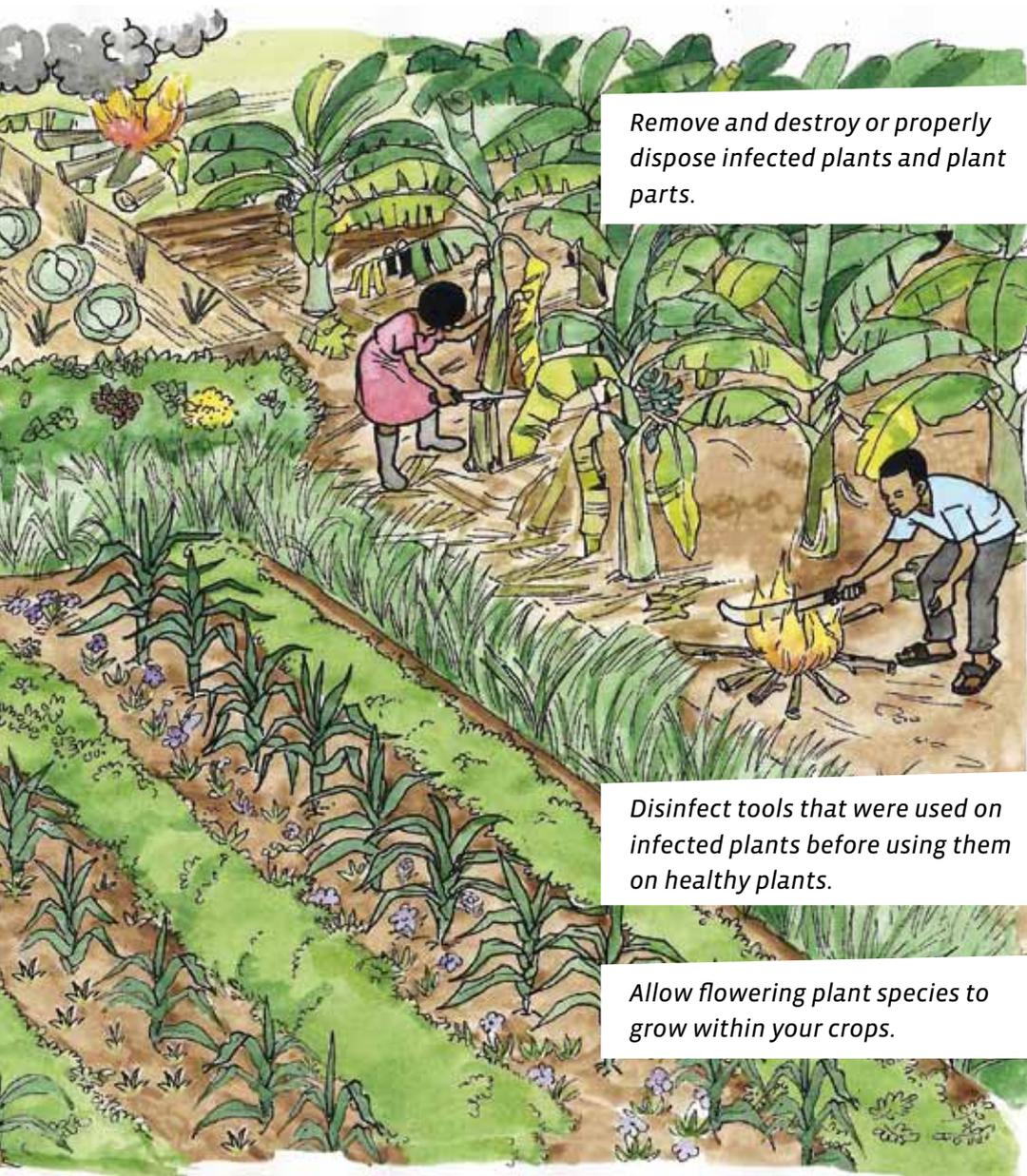
*Plant hedges of indigenous plant species around fields.*



*Remove alternative hosts of pests and diseases.*



*Grow trap plants that divert pests from crops or grow plants that keep pests away from crops.*



*Remove and destroy or properly dispose infected plants and plant parts.*

*Disinfect tools that were used on infected plants before using them on healthy plants.*

*Allow flowering plant species to grow within your crops.*

## 3<sup>rd</sup> step: direct control

### Minimizing negative impact

In situations of heavy infestations or very devastating pests and diseases, direct measures may be necessary to prevent economic crop losses. These practices will, however, only be fully effective, if the practices in the 1<sup>st</sup> and 2<sup>nd</sup> steps were and are well applied.

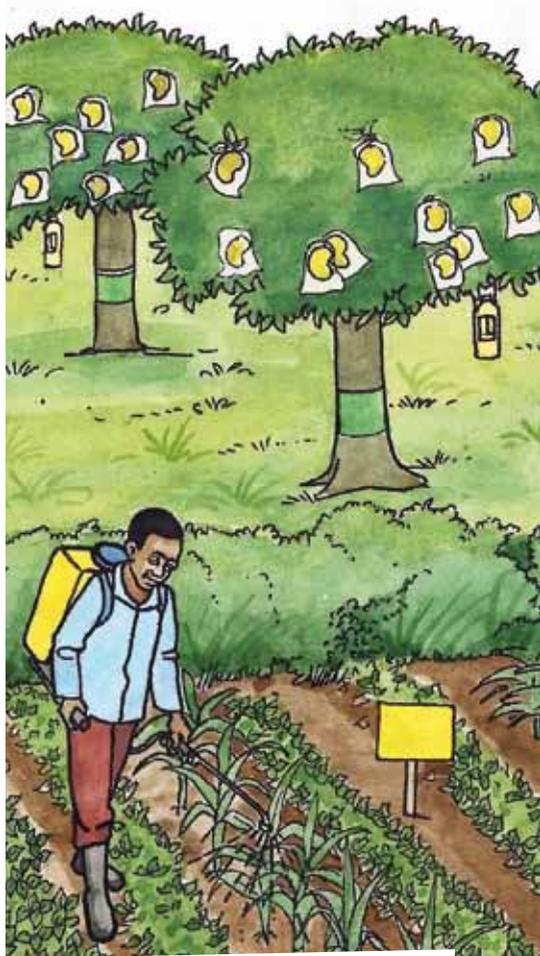
Approved or self-made insecticides (or acaricides) and fungicides of biological or mineral origin such as plant extracts, plant oils, mineral oil, copper and sulphur are used to control specific pests and diseases.

Commercial products using living organisms for pest control involve insect and mite predators, insect parasitoids, viruses and bacteria.

Insect pheromone traps are used to disrupt mating of insect pests. Bait, light and colour traps are efficient for mass-trapping of insect pests.

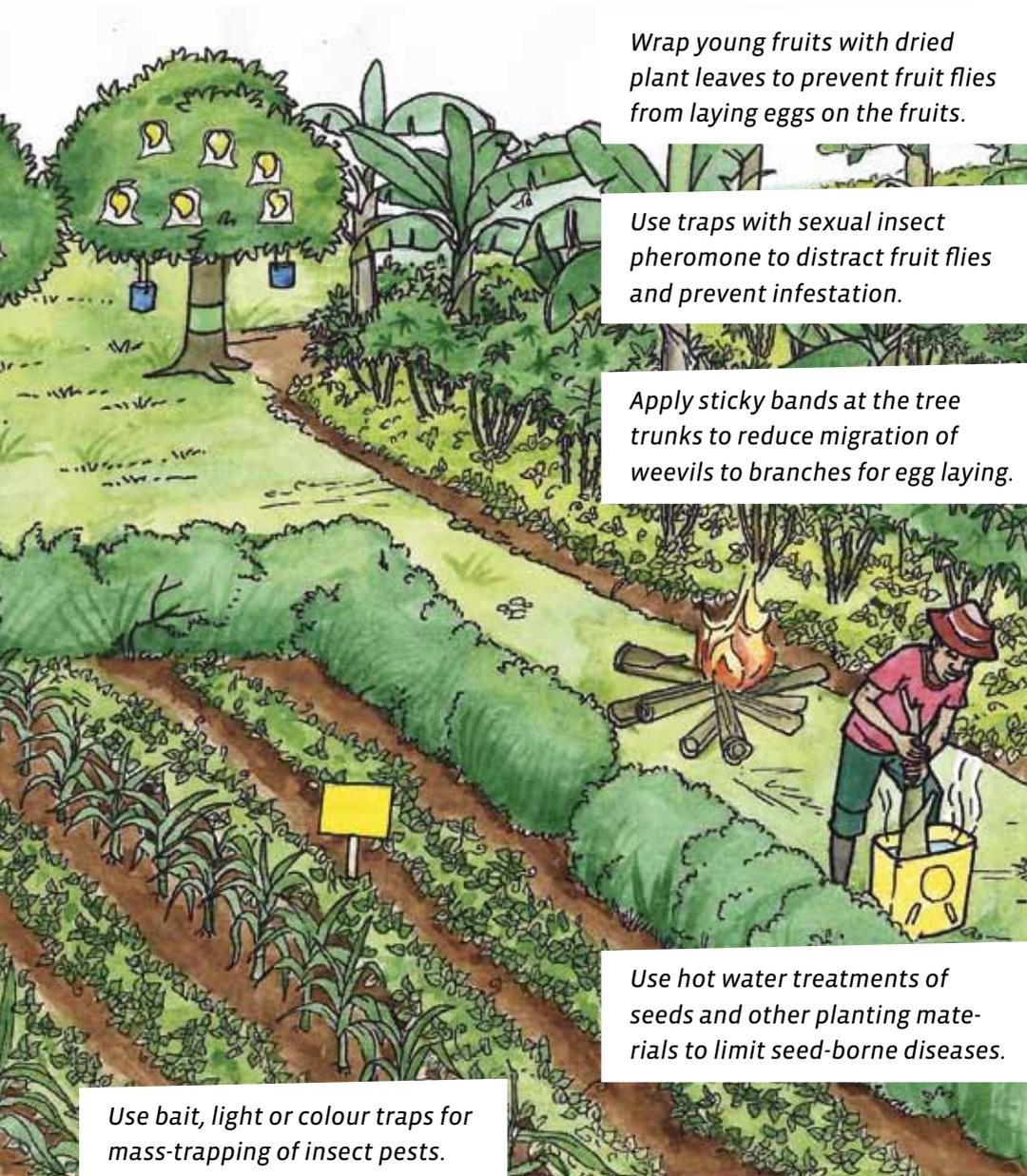
Hot water treatment of seeds and planting materials limits propagation of diseases from one field to the other.

**Do you know** which plants can be used to prepare botanical preparations?



*Use natural pesticides with a narrow range of activity to avoid damage to beneficial insects.*





*Wrap young fruits with dried plant leaves to prevent fruit flies from laying eggs on the fruits.*

*Use traps with sexual insect pheromone to distract fruit flies and prevent infestation.*

*Apply sticky bands at the tree trunks to reduce migration of weevils to branches for egg laying.*

*Use hot water treatments of seeds and other planting materials to limit seed-borne diseases.*

*Use bait, light or colour traps for mass-trapping of insect pests.*

This booklet is an outcome of the African Organic Agriculture Training Manual project and was conceived as a handout for farmers.

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