ROUTE TO FOOD

Farmers' Resource Guide:

Achieving Food Production without Toxic Pesticides

HEINRICH BÖLL STIFTUNG
NAIROBI
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Foreword

Dear Farmers and Friends,

Farming is at the heart of Kenya's economy and key of the well-being of its people. Yet, the use of harmful pesticides, called Highly Hazardous Pesticides (HHPs), has put our health, our food, and our environment in danger. Many of these pesticides are banned in other parts of the world, but are still widely used here. They leave toxic residues on our food, harm our health, damage the soil, and kill bees and other helpful insects that are essential for farming.

This *Farmers' Resource Guide: Achieving food production without Toxic Pesticides* is here to help you. It builds on the findings of our 2023 report, titled Toxic Business: Highly Hazardous Pesticides (HHPs) in Kenya, which exposed the heavy reliance on these dangerous chemicals in Kenya. It showed that 76% of the pesticides used on farms are highly hazardous, despite their risks to our health and the environment. But there is good news - there are safer and more sustainable ways to grow food, and this guide will show you how.

The guide is full of practical advice and easy to follow steps. You will learn how to make your soil healthier, use natural methods to manage pests and diseases, and reduce your costs while growing safe food for your family and community.

At Heinrich Böll Foundation, we believe every farmer can succeed without toxic pesticides. We believe in knowledge rather than chemical inputs. By using methods like crop rotation, companion planting, and use of biopesticides, you can protect your crops and the land for future generations. This guide is your companion on this journey to safer, healthier farming.

Thank you for your hard work and dedication to feeding Kenya. Together, we can build a brighter future for our farms, our families and our environment.

Joachim Paul
Director, Heinrich Böll Foundation.
Nairobi

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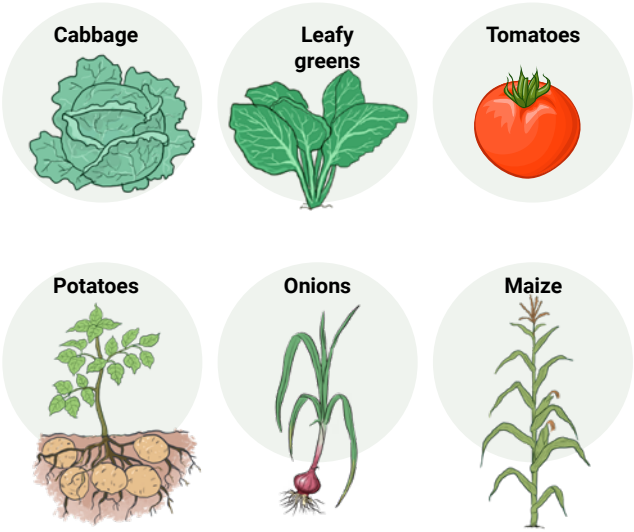
Chapter 1:
Introduction

The **Farmers' Resource Guide: Achieving Food Production without Toxic Pesticide'** is based on a 2023 report that exposed the harmful use of dangerous pesticides (called Highly Hazardous Pesticides) in crops, including maize, cabbage, leafy greens, tomatoes, and onions. These chemicals harm human health, damage the environment, and compromise our fragile ecosystems.

Scan to read full report

https://tinyurl.com/35nxmwcm



Welcome to a new era in farming—one where **health, sustainability,** and the **long-term well-being** of our land and generations come first. This guide is your companion on a journey away from toxic pesticides, that are called "highly hazardous pesticides (HHPs)". Here, you'll meet Furaha and Baraka, two trusted guides who will walk with you, providing step-by-step advice to replace these harmful pesticides with sustainable practices to protect your crops, your income and your health.

Why this guide is important for farmers

Food safety is urgent: Toxic pesticide residues in our food have become a widespread health risk, impacting both farmers and consumers. Every meal should nourish us, not expose us to harmful toxic chemicals.

Soil degradation is a growing crisis: Over time, synthetic pesticides and fertilizers strip away the richness of our soil, making it harder to grow strong, resilient crops. A shift to natural methods can rebuild this life-giving resource.

Farming costs are rising: Toxic pesticides come at a high price, pushing you towards unsustainable practices that ultimately cost more than they give back. Safer, sustainable methods help reduce expenses and boost profitability.

Breaking free from dangerous beliefs

We must drop the misguided belief that we have to use harsh chemical inputs in order to produce enough food. This reliance has caused irreversible damage to our health, our farms, and our environment.

How can we do that?

There is another way—one that supports healthy soils, thriving crops, and long-term farming success. Follow me throughout this guidance for more information.

Importance of the guide

This guide is tailored for farmers ready to break free from Highly Hazardous Pesticides and embrace a safer approach. Whether you are just starting or have years of experience, these practical methods are here to help you grow a pest-resilient farm that will serve you and your community well.

Field-ready advice: This is a hands-on tool, designed by farmers and experts for use directly in the field as you work through the farming season.

Simple tips with clear visuals: Easy-to-follow illustrations make each step straightforward, even if you're new to these techniques.

A sustainable journey: Each step forward is part of a larger commitment to sustainable farming practices that yield benefits over time. Change doesn't happen in a day, but every action adds up.

How to use this guide

Read slowly and take notes.

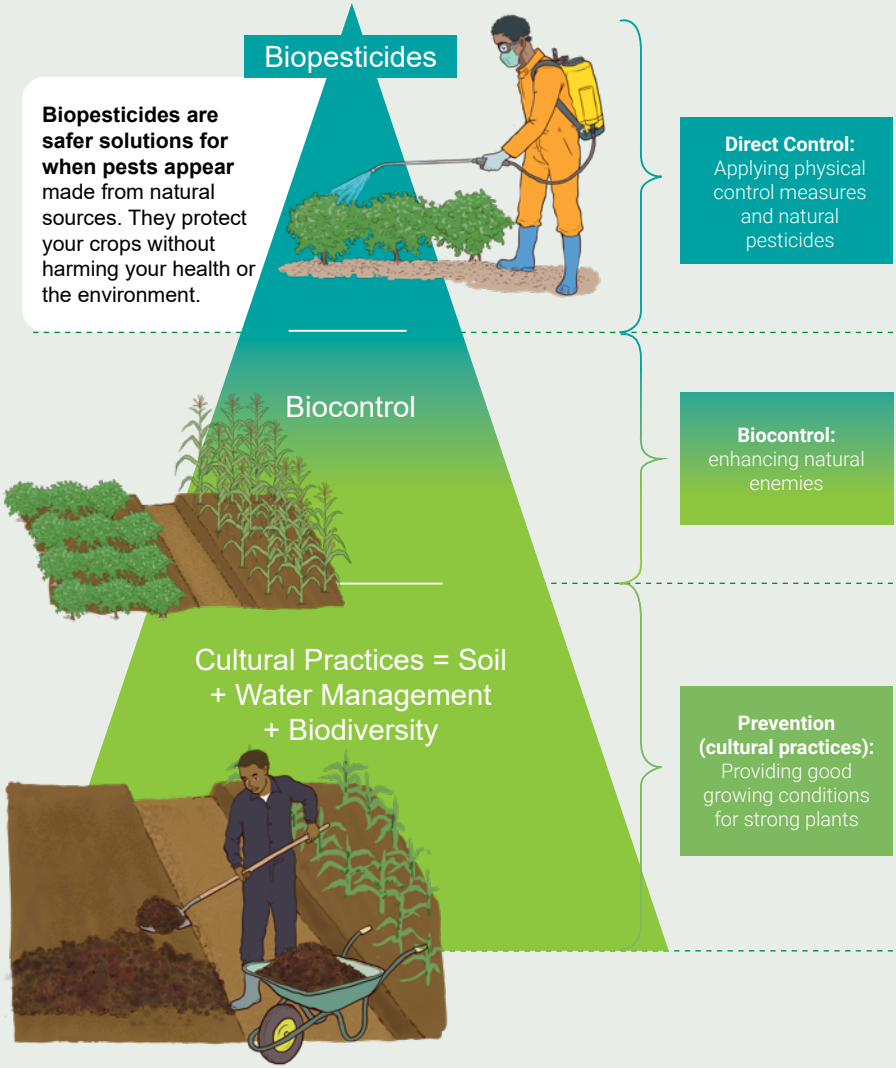
Share the guide with fellow farmers.

Teach fellow farmers what you learn in the guide.

It's time to embrace safer, sustainable practices

Pest Control Approach

This guide focuses on **prevention – the goal is simple:** keeping pests from becoming a problem by building healthy soil and encouraging biodiversity.



Preventing pests naturally through cultural practices

The key is healthy soil and biodiversity: Healthy soil is the foundation of a strong, pest-resistant farm. Using methods like rotating crops, adding compost, cover crops, and companion planting, you will make your soil richer and help your crops grow stronger and more resilient. A healthy farm, supported by biodiversity, naturally discourages pests.

Regular scouting: Preventing pests also means keeping an eye on your fields. **Regular scouting**—checking for early signs of pests—helps you catch issues before they spread.

Nature can help too: We can also let **nature fight pests for us** by encouraging beneficial insects and animals that feed on crop-damaging pests. This natural control, called **biocontrol**, is a safe, effective way to protect your farm without chemicals.

Healthy Soil

- Is rich in humus
- Is rich in life
- Has a stable stucture
- Allows water penetration
- Is resistant against soil erosion
- Habours no pests, diseases or weeds

Chapter 2:

Why we need Safer Food Production

Hey, do we really use toxic pesticides on our crops?

Yes, quite a lot, actually. They are known as Highly Hazardous Pesticides, HHPs in short.

Wow… which crops are we spraying with these?

Mostly maize, leafy greens, tomatoes, potatoes, onions and cabbage.

Wait, aren't those crops we eat almost every day?

Exactly. And that's the issue—the pesticides stay on the crops and can harm not only us but also everyone who eats them.

So, are these pesticides really that dangerous?

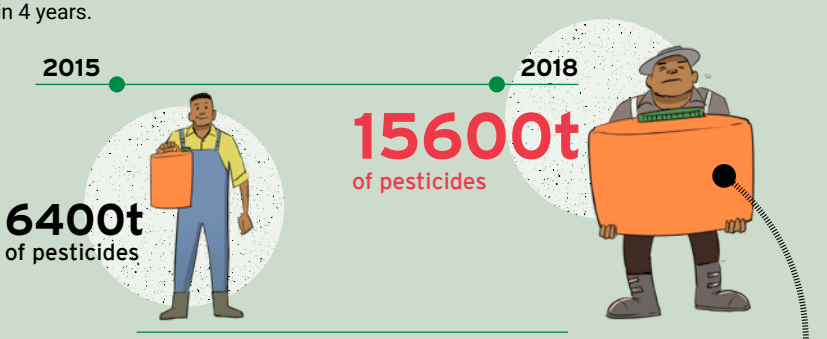
Yes. They can cause everything from acute poisoning to long-term diseases. These chemicals do not just disappear—they leave residues on our food.

Then we have to find a better way. We cannot keep risking our health and the health of others.

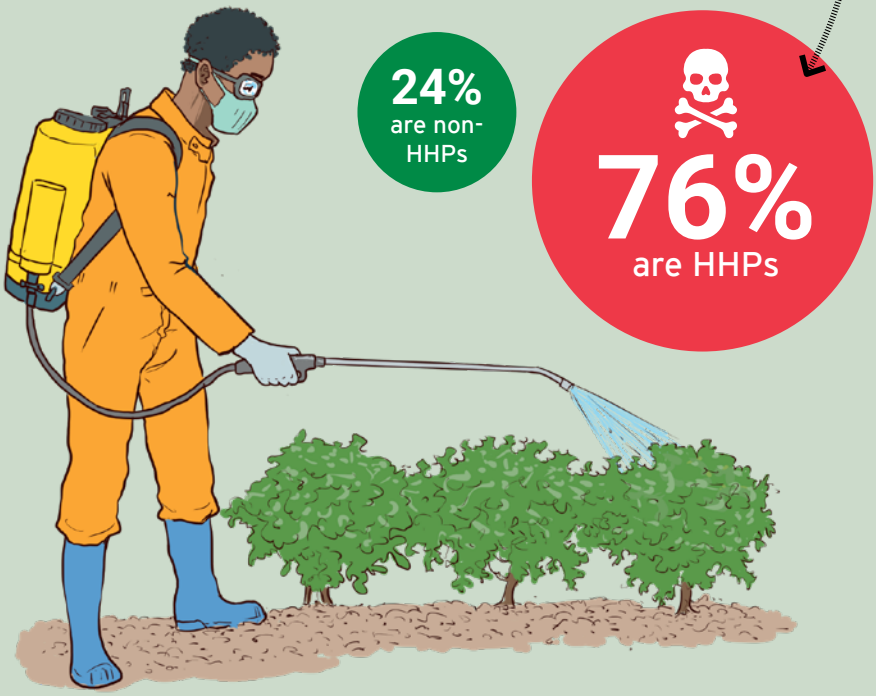
I agree. That's what this guide is for—to help us grow our crops safely and sustainably without relying on hazardous chemicals.

Pesticide use in Kenya

Farmers are using more and more pesticides in the past 40 years. The amount has more than doubled within 4 years.



Most pesticides used by farmers in Kenya are highly hazardous.



What are Highly Hazardous Pesticides (HHPs)?

Pesticides can make you sick!

HHPs, or Highly Hazardous Pesticides, are insecticides, fungicides and herbicides that can seriously harm people and the environment. They cause acute poisoning if you not protect yourself: About 350,000 cases of pesticide poisoning are related to HHPs. And some of these pesticides are so dangerous that they can cause severe or permanent health damage.

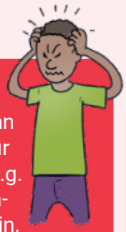
Many of the pesticides we use are harmful

5 active ingredients can cause **cancer** (e.g. chlorothalonil, glyphosate)

Thats why you need to wear full personal protection equipment including boots, overall, gloves and mask.

35 active ingredients can harm your **ability to have children** and the health of your unborn baby. (e.g. carbendazim, chlorpyrifos, chlorothalonil, imidacloprid, propineb, dimethoate, linuron).

20 active ingredients can be harmful to your **nervous system** (e.g. chlorpyrifos, beta-cyfluthrin, bifenthrin, dimethoate).



30% of farmers do not wear any Personal Protection Equipment (PPE) while spraying. This is very dangerous.

Many HHPs can also harm the environment around us. The environment we need for food production.

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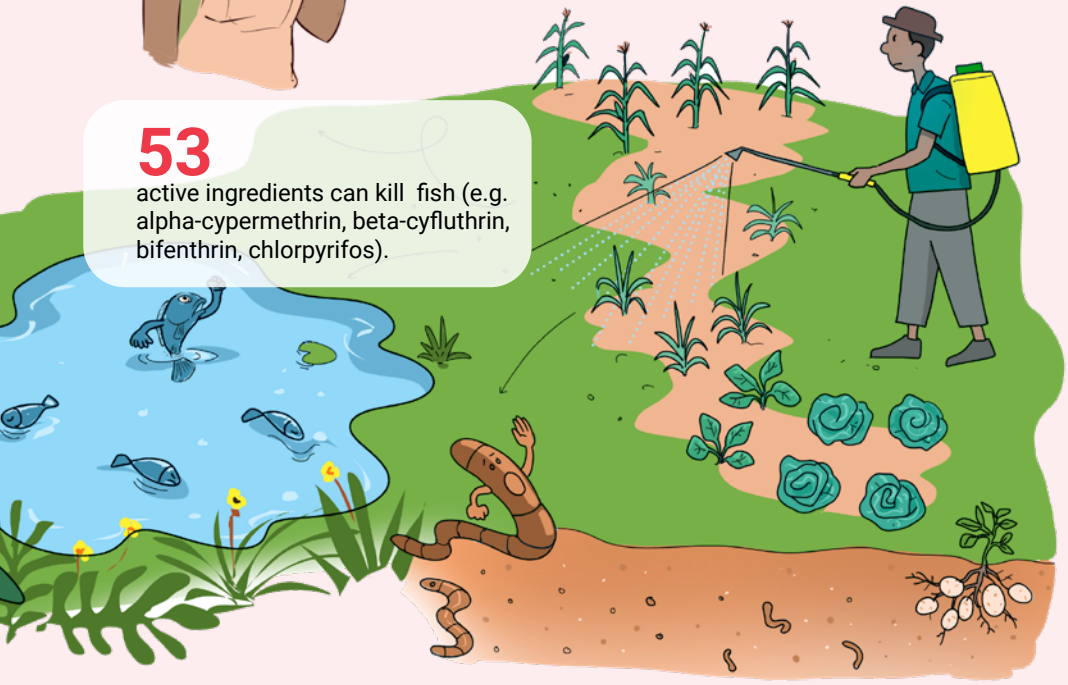
active ingredients can kill bees and other useful insects (natural enemies). (e.g. thiamethoxam, imidacloprid, chlorpyrifos, alpha-cypermethrin).

Do you know that we need bees for a good yield and beneficial insects to help us fight against the pests?

53

active ingredients can kill fish (e.g. alpha-cypermethrin, beta-cyfluthrin, bifenthrin, chlorpyrifos).



Pesticides can also harm soil health. The soil with all it's microbes, insects and fungi that help break down organic matter, improve soil structure and support plant growth. If they are killed soil fertility goes down.

Nearly half of the pesticides used by farmers in Kenya are banned in other countries.

Why are pesticides banned elsewhere?

In many other countries, pesticides are allowed to be used for a certain period of time. After that, they have to go through a process called re-registration. During re-registration, new information about the pesticide, like how it affects the environment and human health, is looked at. If there's a high risk that the pesticide could harm people or nature, it won't be allowed anymore and will be banned. But even if it's banned in e.g. Europe, European pesticide companies can still sell it to countries like Kenya. This is called **Double Standard**. It is the Kenyan government's responsibility to make sure that only pesticides, which don't seriously harm people's health and the environment, are allowed and that safer alternatives are available for producing healthy food.

How to read the label

Each pesticide bottle clearly labels the active ingredients. It's important to learn the names of these ingredients so you can choose pesticides that are less harmful (marked in green) or recognize those that are more harmful to your health and the environment (marked in orange or red).

How to read a Pesticide product label

- Read the entire label
- The label is the law
- Below is an example of information found on a pesticide product label

READ THE LABEL BEFORE USING
(SOMA KIBANDIKO KABLA TA KUTUMIA)

KEEP LOCKED AND OUT OF REACH OF CHILDREN
(FUNGIA MBALI NA WATOTO)

In case of poisoning call Toll Free No. (24hrs)
(Wakati wa kusumika piga simu bila malipo (inapatikana masaa 24) kwa **1234567456**

SHELF LIFE: 2 years from date of manufacture if stored in its original unopened container in a cool, dry and well venilated place.
(MAISHA RAFUNI: Miaka miwili toka tarehe ya kutengenezwa ikiwa kwenye chombo chake kisichofunguliwa kwenye sehemu kavu, pasipo joto jingi na panapoingiza hewa).

BATCH NO; HDT-546485758
(NAMBARI YA FUNGU):
mfg Date 10/05/2024
(Tarehe ya kutengenezwa):
Expiry Date 09/05/2029
(Tumia kabla ya):

GUARANTEE (DHAMANA)
CYMOXANIL 8% + MANCOZEB 64%

ACTIVE INGREDIENT

Agent/Distributed By
(Wakala,/ Husambazwa na):

COMPANY CHEMICALS
P.O. Box 123456 00400 Nbi, Kenya
Phone: +254 123456789/
987654321

SMS: 999999
Fax: +25401234567
E-mail: company@company.com
Web: www.comany.co.ke

Manufacturer (imetengenezwa na):
COMPANY INDUSTRIES
4th floor, house, street
Nairobi, Kenya

EXP MM-DD-YYYY

5 55555 55555 5

FOR MORE INFORMATION READ THE ATTACHED LEAFLET
KWA MAELEZO ZAIDI, SOMA UKURASA ULIOBANDIKWA

Crops with highest application of Highly Hazardous Pesticides

Tomatoes 75 different HHPs

Maize 42 different HHPs

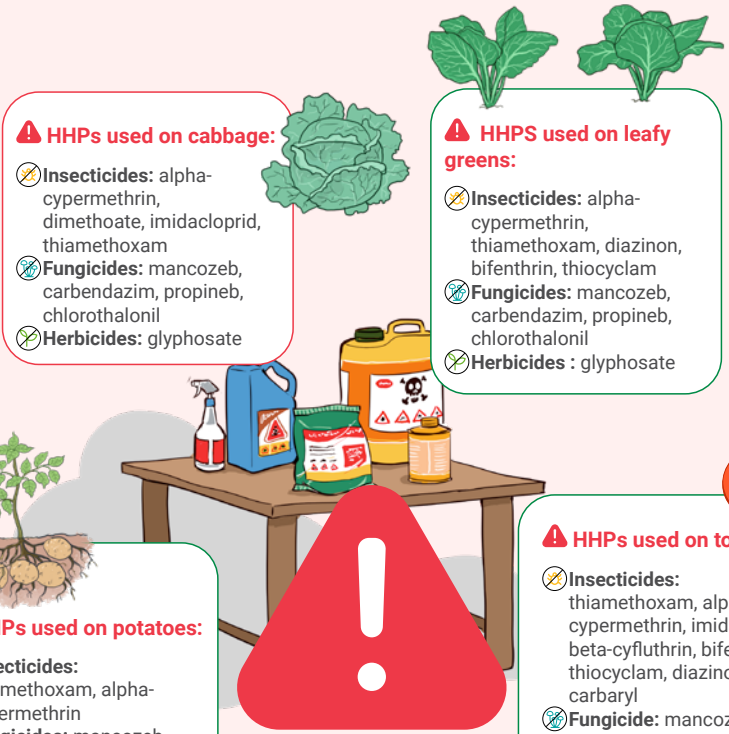
Cabbage 31 different HHPs

Onions 16 different HHPs

Leafy Greens 22 different HHPs

Potatoes 24 different HHPs

Many pests and weeds have developed resistance to pesticides, especially when sprayed too often or with incorrect amounts. This means the pesticides is not working anymore because the pests adapt to survive the chemicals.



HHPs used on cabbage:

- **Insecticides:** alpha-cypermethrin, dimethoate, imidacloprid, thiamethoxam
- **Fungicides:** mancozeb, carbendazim, propineb, chlorothalonil
- **Herbicides:** glyphosate

HHPS used on leafy greens:

- **Insecticides:** alpha-cypermethrin, thiamethoxam, diazinon, bifenthrin, thiocyclam
- **Fungicides:** mancozeb, carbendazim, propineb, chlorothalonil
- **Herbicides :** glyphosate

HHPs used on potatoes:

- **Insecticides:** thiamethoxam, alpha-cypermethrin
- **Fungicides:** mancozeb, propineb
- **Herbicides:** linuron

Don't use them

HHPs used on tomatoes:

- **Insecticides:** thiamethoxam, alpha-cypermethrin, imidacloprid, beta-cyfluthrin, bifenthrin, thiocyclam, diazinon, carbaryl
- **Fungicide:** mancozeb, propineb, chlorothalonil
- **Herbicides:** glyphosate

HHPs used on onions:

- **Insecticides:** alpha-cypermethrin, thiamethoxam, imidacloprid, profenofos
- **Fungicides:** carbendazim, mancozeb
- **Herbicides:** glyphosate

HHPs used on maize:

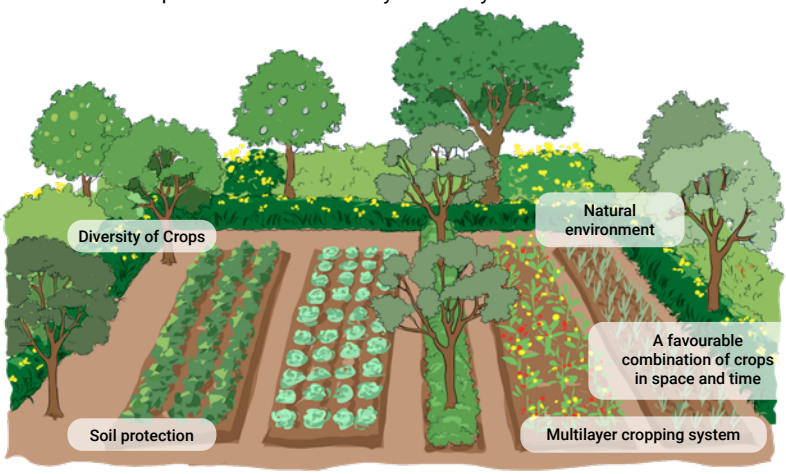
- **Insecticides:** carbosulfan, beta-cyfluthrin, imidacloprid, chlorpyrifos, alpha-cypermethrin
- **Fungicides:** epoxiconazole
- **Herbicides:** paraquat, 2,4-D, glyphosate, atrazine

For more information on health and environmental effects please go to page 47

Chapter 3:
Natural Control of Pests and Diseases

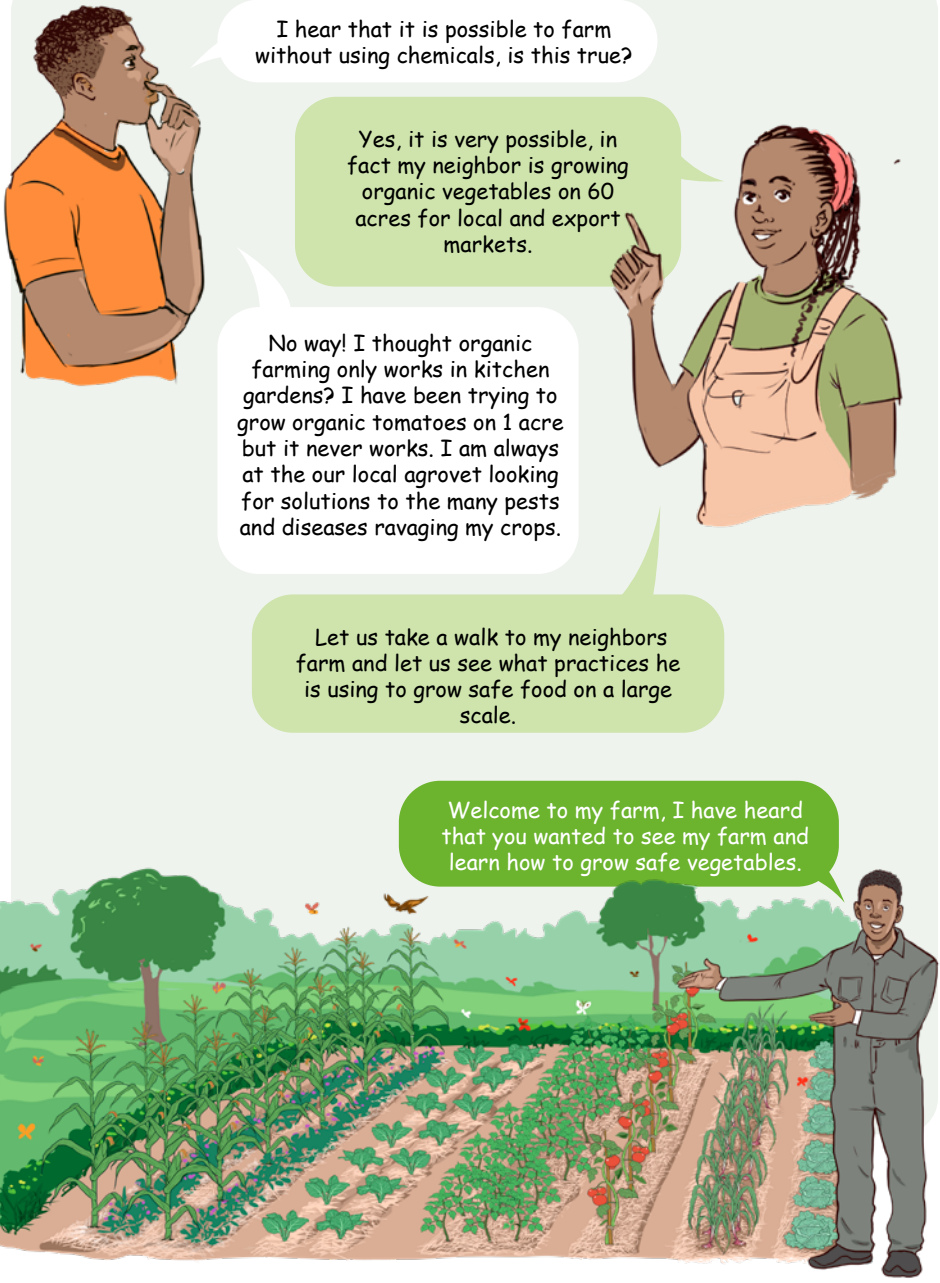
Good farm management

A diverse cropping system creates a favourable micro-climate, contributes to better soil fertility, reduces the risk of crop losses and increases yield safety.



Bad farm management

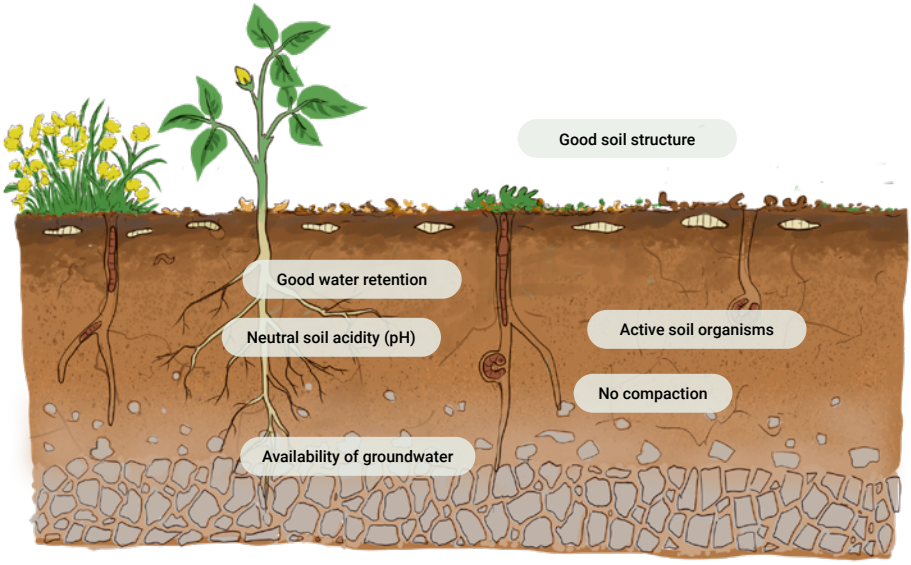
Bad farming practices, like not protecting the soil, monocropping, and overusing toxic pesticides, can damage the land and harm plants. These practices wear out the soil, increase pests and diseases, and raise the risk of losing crops.


I hear that it is possible to farm without using chemicals, is this true?
Yes, it is very possible, in fact my neighbor is growing organic vegetables on 60 acres for local and export markets.
No way! I thought organic farming only works in kitchen gardens? I have been trying to grow organic tomatoes on 1 acre but it never works. I am always at the our local agrovet looking for solutions to the many pests and diseases ravaging my crops.
Let us take a walk to my neighbors farm and let us see what practices he is using to grow safe food on a large scale.
Welcome to my farm, I have heard that you wanted to see my farm and learn how to grow safe vegetables.

Avoiding or using fewer harmful pesticides is crucial for the health of our body, our farms and the environment. Healthy soil and high biodiversity leads to healthy plants, which means fewer pests. In this manual, we will explore how to achieve this balance and find alternatives to using harmful pesticides.

Soil health + diversity
= Healthy plants + healthy farm system
= less pests and diseases

Soil is the foundation of everything



Start with the soil

The foundation of thriving crops lies in the health of the soil. Just as a healthy body has a stronger immune system to fight off illness, plants growing in nutrient rich, and well-balanced soil develop their own 'natural immunity.' This enables them to resist pests and diseases more effectively. Healthy soil supports beneficial microorganisms that actively contribute to plant growth, creating a strong, self-sustaining system. By taking care of your soil, you are not just feeding your plant, but rather building a strong, self sustaining ecosystem.

Below the ground strategies include **good soil and water management**, making sure your soil is moist, alive and full of nutrients and organic matter.

Three steps of organic soil fertility management

1st step: Soil and water conservation
Stabilizing and protecting the soil and harvesting and conserving water

- Contour ridges
- Mulching
- Grass strips
- Cover crops
- Terraces
- Reduced tillage

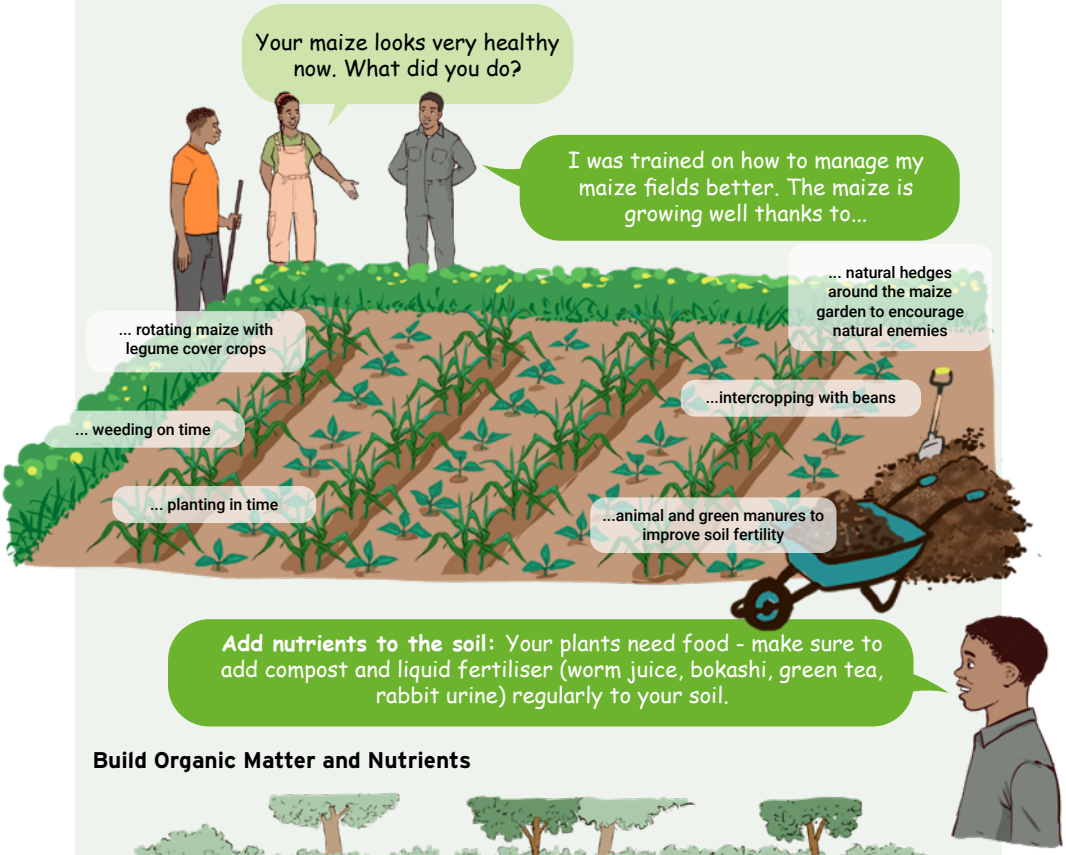
2nd step: Soil organic matter management
Enhancing soil organic matter content through application of organic material

- Green manures
- Animal manures
- Compost
- Mulching

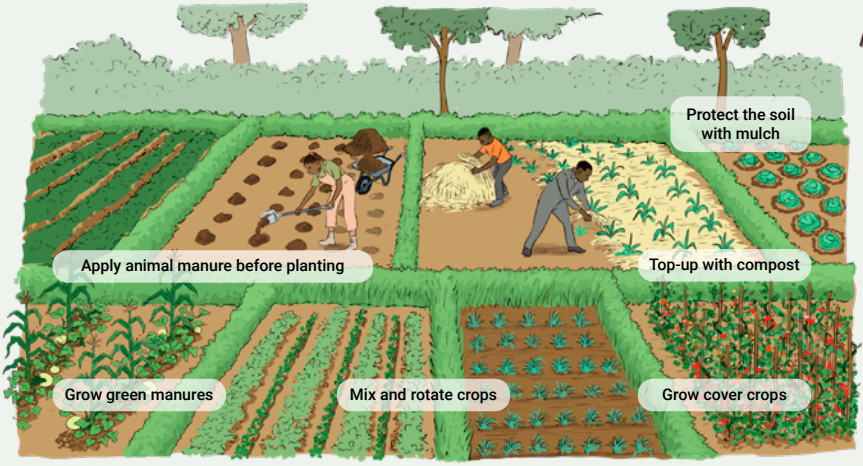
3rd step: Application of supplements
Enhancing and balancing plant nutrition through application of fertilizers, soil amendments and irrigation

- Liquid fertilisers

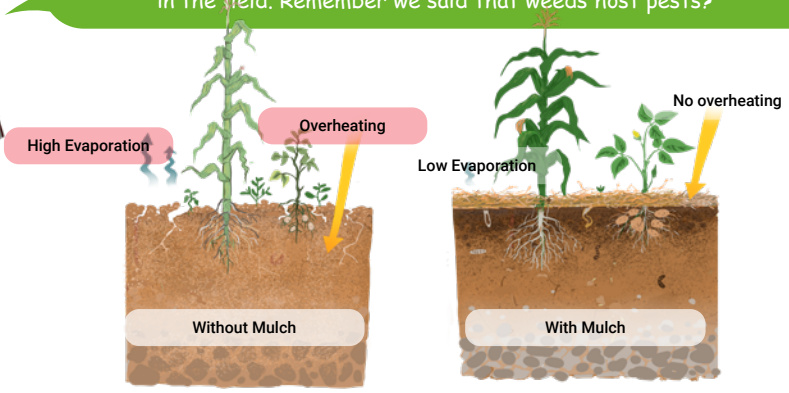
Proper field establishment and crop management



Build Organic Matter and Nutrients

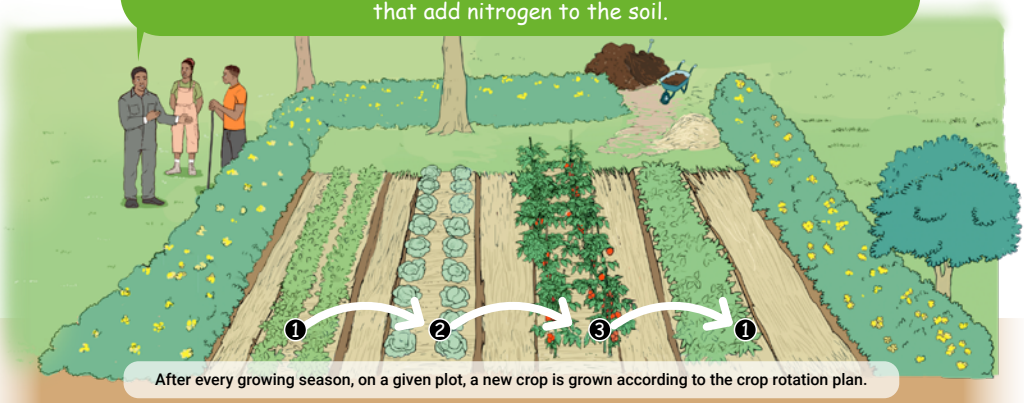


Protect your soil with Mulching: Mulching and covering the soil not only helps to retain moisture in the soil but also prevent the growth of weeds in the field. Remember we said that weeds host pests?



Grow different crops

Crop Rotation: One effective way of cutting short the life cycle of pests and diseases is to rotate our crops. Do not plant the same crop consecutively. Rotate crops that help build the soil. For example, after harvesting a heavy feeder crop like onions, rotate it with beans or lentils that add nitrogen to the soil.



After every growing season, on a given plot, a new crop is grown according to the crop rotation plan.

1	2	3	1
Green Manure or legume crop e.g. velvet bean, sunhemp, bean or pea	**Heavy feeder** e.g. cabbage, broccoli, kale, spinach	**Mediaum or light feeder** e.g. tomato, pepper, potato, carrot, onion	**Green Manure or legume crop** e.g. velvet bean, sunhemp, bean or pea

Recommended

- **Laying out the field** into different plots
- Selecting at **least two vegetable types and a legume (green manure)** crop to allow rotation
- The rotation principles also apply when different crops are intercropped

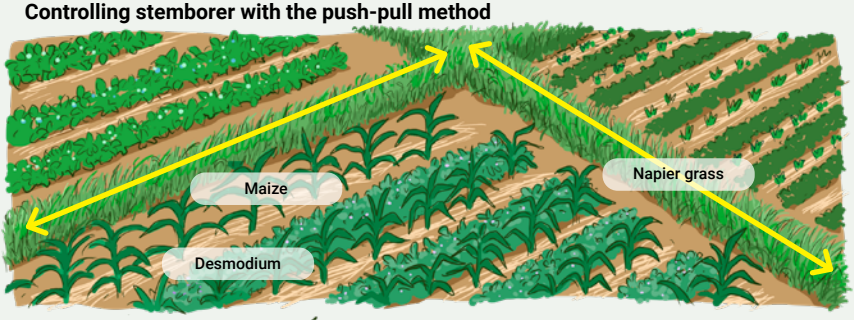
Not Recommended

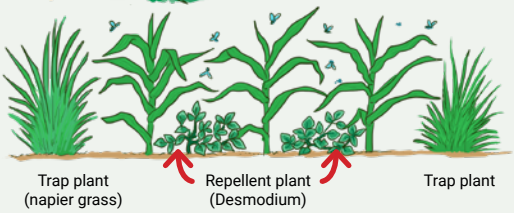
- Planting the **same vegetable or vegetables of the same family on the same spot for two consecutive seasons**
- Using **vegetable residues as mulch** in the same field with a vegetable of the same type of same family

Grow different crops

Companion Planting or Intercropping: Grow different plants on your farms that help each other. Did you know that some plants are able to repel pests when planted together? You can try plant cabbage with leeks and notice that DiamondBack Moth will not affect your cabbage. Or try to plant carrots with onions to repel the carrot fly. A well-known example is the push-pull method in growing maize: Planting Desmodium between the maize plants and Napier grass around the edges of the field. Desmodium adds nitrogen to the soil for the maize and its smell 'pushes' the stem borer pests away. The Napier grass around the field 'pulls' the pests out of the field.

Controlling stemborer with the push-pull method



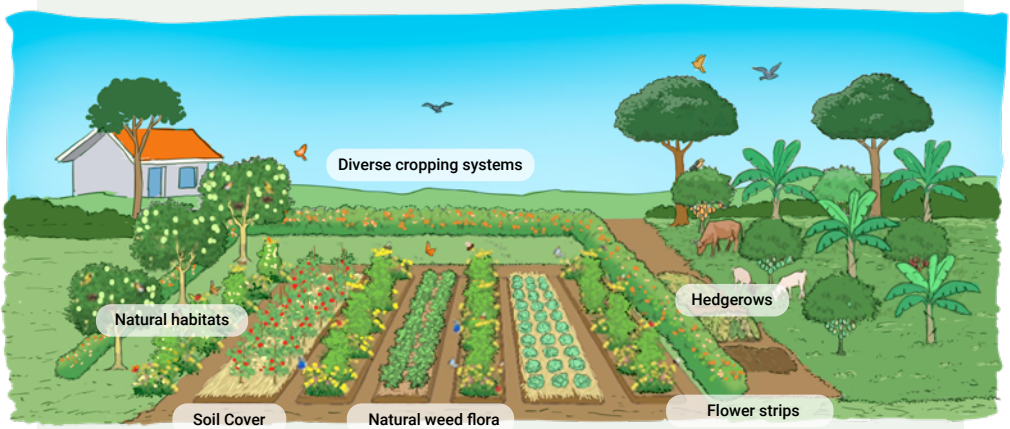


The trap crop is more attractive to the pest either as alternative food source or egg laying site than the main crop

The repellent crop produces an odour that 'pushes' the pest away

Great! Now that we've explored how to build healthy soil, let's take a closer look at the alternative methods I use to control pests and diseases effectively.

Promotion of natural enemies to control pests



Look out for pests and diseases. Early identification is key as you are able to manage the spread and infestation

Physical removal of pests and infected plants

When you notice infestation of pests and infected plants, it is important to physically remove and burn them. When you physically remove infected plants you cut the life cycle of pests and leave healthy plants to thrive.

Physical control: Timely weeding

Did you know that weeds host a number of pests and diseases? Timely weeding is key. Ensure that your field is always free of weeds.

Tip- Make sure you also weed the edges and fence of your field. Pests like to hide in the weeds. If you do not weed the edges of your garden, the pests will always give you a hard time.

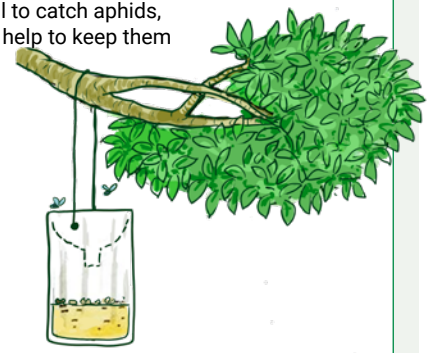
Biological control

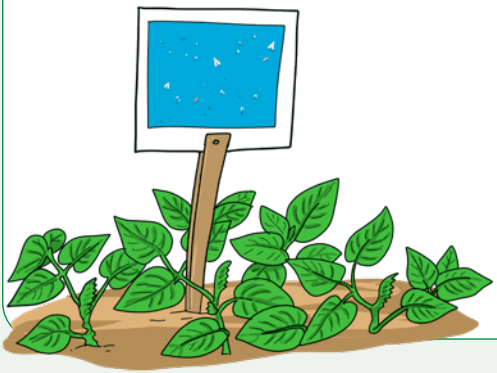
Did you know that not all insects are harmful? In fact, nature maintains a delicate balance where every organism has a natural enemy.

When we use harsh chemicals on our plants, we disrupt this balance and harm beneficial insects - our 'farmer friends'- that help keep pests in check. For example, if you spot a ladybird on your farm, it's a sign of nature at work; ladybirds feast on aphids, keeping their numbers under control.

Similarly, the praying mantis is a valuable friend, tirelessly feeding on pests day and night, reducing infestations without the need for chemical intervention.

You can use yellow traps covered with sticky oil to catch aphids, whiteflies and blue traps to collect thrips. They help to keep them out of your field.



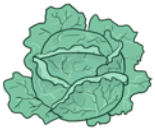


Chapter 4:
Crop Specific Pest and Disease Control

Let us explore now how we can control common pests and diseases on six different common crops.

The table below shows common pests and diseases affecting the top five crops. Farmers often struggle to find information on biocontrol and biopesticides and end up relying on agro-dealers. Here, you'll find practical solutions to control pests and diseases without using chemical pesticides.

Cabbage



Pests: Aphids

Cultural Practices:

- Intercrop with leeks or onions.
- Physically remove infested plants
- Plant hedges and flowers in the field to attract natural enemies.

Biopesticide: Neem oil, Ash brew, Apichi, Rabbit urine, use yellow traps

Pests: Diamondback Moth

Cultural Practices:

- Intercrop with non host plants such as onions and Tomatoes

Biopesticide: Neem oil, Ash brew, Apichi

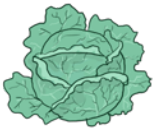
Pests: Thrips

Cultural Practices:

- Plant hedges and flowers to attract natural enemies
- Use blue traps

Biopesticide: Neem oil Pyrethrin, use blue traps

Cabbage



Diseases:
Damping off

Cultural Practices:

- Avoid over watering.
- Plant in raised beds to reduce moisture content in the roots.
- Crop rotation for 3 years with beans, maize, onions or spinach.

Biopesticide: Trichoderma (beneficial fungus)

Diseases:
Powdery Mildew

Cultural Practices:

- Crop rotation with non-brassica crops
- Water cabbages early morning
- Physically remove infected leaves.

Biopesticide: Spray with bicarbonate or soda mix solution, organic based fungicide

Leafy Greens

Pests:
Aphids (Black)

Cultural Practices:
- Plant hedges and flowers to attract natural enemies.
- Physically remove infected plants
- Intercrop with onions

Biopesticide: Neem oil
Soap solution, Aphichi, Ash brew, use yellow traps, Rabbit urine

Pests:
Leafminer

Cultural Practices:
- Plant hedges and flowers to attract natural enemies.
- Physically remove infected plants
- Intercrop with onions

Biopesticide: Neem oil, Pyrethrin

Pests:
Cutworms

Cultural Practices:
- Scout and remove them physically
- Apply ash at the base of the crop

Biopesticide: Neem oil, rabbit urine and Apichi

Pests:
Spidermite

Cultural Practices:
- Irrigate adequately to avoid plant stress
- Timely weeding
- Physically remove infected plants

Biopesticide: Neem oil, Pyrethrin

Leafy Greens

Diseases:
Downy Mildew

Cultural Practices:
- Prune infected leaves
- Ensure the plants are well aerated

Biopesticide:
- Milk Solution
- Bicarbonate of soda solution
- Organic Copper based fungicide

Diseases:
Bacterial Wilt

Cultural Practices:
- Physically remove infected plants
- Practice crop crop rotation with crops that are not in the Solanacea family
- Use certified/ clean seed
- Plant in well composted soils

Biopesticide: Bacillus Subtilis solution (beneficial bacteria)

Diseases:
Damping off

Cultural Practices:
- Plant in warm and moist soils and avoid planting seeds or transplants in cold, wet and compacted soils

Biopesticide:
- Trichoderma (beneficial fungus)

Potatoes

Pests:
Spidermite

Cultural Practices:
- Irrigate adequately to avoid plant stress
- Timely weeding
- Physically remove infected plants

Biopesticide: Neem oil, Pyrethrin

Pests:
Aphids

Cultural Practices:
- Intercrop with leeks or onions.
- Physically remove infested plants
- Plant hedges and flowers in the field to attract natural enemies.

Biopesticide: Neem oil, Ash brew, Apichi, use yellow traps

Pests:
Potatoes Cyst Nematodes

Cultural Practices:
- Use certified and clean seed
- Practice crop rotation with crops that are not in the Solanacea family
- Addition of organic soil matter to improve soil structure.

Pests:
Whitefly

Cultural Practices:
- Use yellow sticky traps

Biopesticide: Neem oil, Soap solutions, use yellow traps

Potatoes

Diseases:
Bacterial Wilt

Cultural Practices:
- Physically remove infected plants
- Practice crop crop rotation with crops that are not in the Solanacea family
- Use certified seeds
- Plant in well composted soils

Biopesticide: Bacillus Subtilis (beneficial bacteria)

Diseases:
Bacterial
Soft Rot

Cultural Practices:
- Crop rotation with fodder or cereals
- Physically remove infected crop and burn it.

Biopesticide: Drench with Trichoderma (beneficial fungus or Bacillus Subtilis (beneficial bacteria)

Diseases:
Early and late blight

Cultural Practices:
- Mulching
- Irrigate in the morning to avoid wetness in leaves

Biopesticide:
- Organic copper based fungicide

Tomatoes

Pests:
Tuta Absoluta (Leafminer)

Cultural Practices:
- Use pheromone traps
- Neem oil
- Introduce parasitic wasps

Pests:
Spidermite

Cultural Practices:
- Irrigate adequately to avoid plant stress
- Timely weeding
- Physically remove infected plants

Biopesticide: Neem oil, Pyrethrin

Pests: Thrips

Cultural Practices:
- Plant hedges and flowers to attract natural enemies
- Use blue traps

Biopesticide: Neem oil
Pyrethrin

Tomatoes

Pests:
Aphids

Cultural Practices:

- Intercrop with leeks or onions.
- Physically remove infested plants
- Plant hedges and flowers in the field to attract natural enemies.

Biopesticide: Neem oil, Ash brew, Apichi, use yellow traps

Pests:
Ball Worm

Pests:
Whitefly

Cultural Practices:

- Use yellow sticky traps

Biopesticide: Neem oil, Soap solutions, use yellow traps

Tomatoes

Diseases:
Blossom End rot

Cultural Practices:
- Avoid irregular watering
- Check soil pH and correct accordingly

Diseases:
Bacterial Wilt

Cultural Practices:
- Physically remove infected plants
- Practice crop crop rotation with crops that are not in the Solanacea family
- Use certified/ clean seed

Biopesticide: Bacillus Subtilis solution

Diseases:
Tomatoes Mosaic Virus

Cultural Practices:
- Control weeds as they act a host crops to Aphids that spread the virus
- Remove and destroy infected plants
- Plant resistant varieties

Biopesticide:
- Spray neem to kill aphids and whitefly that spread the virus

Tomatoes

Diseases:
Early and late blight

Cultural Practices:
- Mulching
- Irrigate in the morning to avoid wetness in leaves

Biopesticide:
- Organic copper based fungicide

Diseases:
Powdery Mildew

Cultural Practices:
- Crop rotate with non-brassica crops
- Water cabbages early morning
- Physically remove infected leaves.

Biopesticide: Spray with Bicarbonate of soda mix solution

Onions

Pests: Thrips

Cultural Practices:

- Plant hedges and flowers to attract natural enemies
- Use blue traps

Biopesticide: Neem oil, pyrethrin, use blue traps

Pests:

Onion Fly

Cultural Practices:

- Intercrop onions with carrots
- Use blue sticky traps

Onions

Diseases:
Anthracnose

Cultural Practices:
- Prune odd diseased portions

Biopesticide:
- Organic Copper

Diseases:
Bacterial soft rot

Cultural Practices:
- Rotate onions and garlic for 2 or more years.
- Cure bulbs thoroughly to allow outer scales and neck tissue to be completely dry.

Maize

Pests:
Fall Army worm

Cultural Practices:
- Push pull Technology (see page 24)

Biopesticide: Neem oil, soap solution, Pepper Spray

Pests:
African Stalkborer

Cultural Practices:
- Push pull Technology

Biopesticide: Neem spray in the heart of the maize, Pyrethrin

Pests:
Ball worm

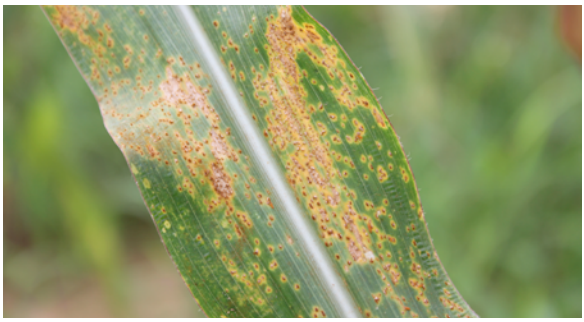
Biopesticide: Garlic spray

Maize

Diseases:
Leaf Rust

Cultural Practices:
- Plant resistant varieties
- Remove and burn all leaf parts affected by the rust

Biopesticide: Neem oil and soap solution



Diseases:
Maize Streak Virus

Cultural Practices:
- Use virus resistant maize.

Diseases:
Common smut

Cultural Practices:
- Destroy infected plants by burning.
- Plant resistant crops
- Crop rotation and ensuring soil fertility

Appendix:
Recipes for Biopesticides

Insecticides

Chilli Spray

Uses:

- **Pest Control:** Effective against soft-bodied insects like aphids, whiteflies, caterpillars, mites, and thrips. The spiciness of chilli acts as an irritant and repellent.
- **Application:** Spray on leaves (also underneath), stems, and fruits.

Materials:

- Fresh chilli peppers (100 g)
- 1 liter of water
- Liquid soap (10 ml) (optional, to help the spray stick to plants)
- Fine strainer or cloth

Steps:

1. **Mash or blend the chilli peppers:** Mash the fresh chilli peppers with some water until smooth.
2. **Boil the mixture:** Add the chilli paste to 1 liter of water and boil for about 15 minutes.
3. **Cool and strain:** Let the mixture cool, then strain it using a fine cloth or strainer to remove the pepper solids.
4. **Add soap (optional):** If using soap, mix in 10 ml of liquid soap. This helps the solution stick to the leaves and pests.

Application:

- **Dilution:** Dilute the chilli spray with water in a 1:2 ratio (1 part chilli spray to 2 parts water).
- **Spray the plants:** Spray the mixture on the leaves and stems of the plants affected by pests like aphids and whiteflies.
- **Frequency:** Apply every 5–7 days or after rain.
- **Quantity:** For small plots, use about 1 liter of the mixture per 10 square meters.

Garlic Spray

Uses:

- **Insect Repellent:** Garlic is a powerful deterrent for pests such as aphids, caterpillars, whiteflies, and leaf miners. Its sulfur compounds act as both a repellent and mild fungicide.
- **Fungal Control:** Helps in controlling mild fungal infections like powdery mildew and rust.
- **Application:** Spray on the plant's foliage and stems.

Materials:

- 10 garlic cloves
- 1 liter of water
- 10 ml liquid soap (optional)
- Strainer

Steps:

1. **Crush the garlic**: Peel and crush 10 garlic cloves.
2. **Mix with water:** Mix the crushed garlic with 1 liter of water and let it sit for 24 hours.
3. **Strain:** Strain the garlic solution using a fine cloth or strainer to remove any solids.
4. **Add soap (optional):** Add 10 ml of liquid soap if desired, to help the spray adhere to the plant surfaces.

Application:

- **Dilution:** Dilute the garlic spray with water in a 1:1 ratio.
- **Spray on plants:** Apply the garlic spray directly on plants, especially those affected by pests such as aphids, caterpillars, and mites.
- **Frequency:** Apply every 5–7 days or after rain.
- **Quantity:** 1 liter of diluted solution per 10 square meters.

Neem Spray

Steps:

1. Collect fresh neem leaves or seeds. (local name – Mwarobaini)
2. Crush the neem seeds or chop the leaves into small pieces.
3. Soak 1 kg of neem in 5 liters of water overnight.
4. Strain the solution the next morning and spray it directly on beans plants, focusing on pods and leaves where pests are found.

Rabbit Urine

Uses:

- **Fertilizer:** Rabbit urine is rich in nitrogen and can be used as an organic foliar fertilizer to promote strong, healthy leaf growth.
- **Insect Repellent:** Helps repel pests like aphids, mites, and grasshoppers.
- **Application:** Use as a foliar spray or apply to soil around the plant.

Materials:

- Fresh rabbit urine (collect 1 liter)
- Water (4 liters)

Steps:

1. **Dilute the urine:** Mix 1 liter of fresh rabbit urine with 4 liters of water.

Application:

- **Spray on plants:** Spray the diluted rabbit urine on the leaves and stems of plants as a foliar fertilizer and pest deterrent.
- **Frequency:** Apply every 2–3 weeks.
- **Quantity:** Use about 1 liter per 10 square meters.

Mexican Sunflower Spray (Tithonia)

Uses:

- **Pest control:** Effective against aphids, caterpillars, and whiteflies.
- **Fertilizer:** Rich in nutrients, improves soil quality when used as a soil drench.

Materials:

- 1 kg of fresh Mexican sunflower leaves
- 5 liters of water
- Strainer

Steps:

1. **Crush leaves:** Crush or chop the leaves finely.
2. **Soak in water:** Add the crushed leaves to 5 liters of water and soak for 24 hours.
3. **Strain:** Strain the mixture to remove solids.

Application:

- **Dilution:** Use the strained liquid without further dilution.
- **Spray on plants:** Use as a foliar spray for pest control (e.g., for aphids and caterpillars) or pour around the base of plants as fertilizer.
- **Frequency:** Apply every 2–3 weeks.
- **Quantity:** 1 liter per 10 square meters.

Wood Ash

Uses:

- **Insect deterrent:** Repels soft-bodied insects like aphids, slugs, and snails.
- **Soil amendment:** Adds potassium and neutralizes acidic soils.

Materials:

- Wood ash (from untreated wood)

Steps:

1. **Collect clean ash:** Gather wood ash after burning untreated wood.
2. **Cool and sift:** Allow the ash to cool, then sift out any large particles or charcoal pieces.

Application:

- **As a dust**: Sprinkle a light layer of ash on the leaves and around the base of plants to deter insects like aphids, snails, and slugs.
- **As a soil amendment:** Mix into the soil to improve nutrient content and deter pests.
- **Frequency:** Apply once a month or after rain.
- **Quantity:** Use about 200 grams per square meter of soil.

Fungicides

Baking Soda (for Fungal Control)

- **Condition:** When fungal diseases like powdery mildew or late blight are a concern, adding baking soda can help.
- **Solution:** Baking soda changes the pH on leaf surfaces, making it inhospitable for fungal spores to grow.

How to Use:

- Add 1 tablespoon of baking soda to 1 liter of Neem oil solution or neem leaf extract.
- Shake well and spray on affected plants.
- Spray regular to prevent fungus to appear (especially during wet season)

Effect: The anti-fungal properties of baking soda helps combat fungal diseases like powdery mildew and late blight more effectively.

Milk Dilution

Dilute milk 1:1 and spray regularly to prevent fungus to appear (especially during wet season)

Others

Fish Emulsion or Fish Soup

Fish emulsion is a nutrient-rich liquid fertilizer made from fish parts and can provide crops with a balanced supply of nutrients and attracts natural enemies.

How to Use Fish Emulsion for Onions:

- **Step 1:** Obtain fish waste such as heads, guts, or bones.
- **Step 2:** Fill a container with water and add the fish waste. Let it decompose for 2-4 weeks, stirring occasionally.
- **Step 3:** Once it becomes liquid, strain it and dilute with water in a ratio of 1:10.
- **Step 4:** Use it to water onion plants or as a foliar spray.
- **Application Rate**: Apply every 2-3 weeks during the growing season.

General guidelines for using additives:

1

Test on a Small Area First: Always do a patch test on a few leaves or a small section of the plant to ensure that the additive does not cause any adverse reactions.

2

Rotate Pesticides: Regularly rotate neem treatments with other organic pest control methods to avoid pests developing resistance.

3

Timing of Application: Apply neem-based solutions in the early morning or late evening to avoid leaf burn and to target pests when they are most active.

The Impact of commonly used pesticides on health and the environment

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Insecticides

Active Ingredient	Products	Number of countries banned	Health effects			Environmental effects		
			Cancer	Reproduction/ unborn baby	Nervous system	Pollination	Water/ Fish	Soil/ earthworm
Alpha-cypermethrin	Fastac, Alphakil, Tata-Alpha, Alpha-Degree	29						
Dimethoate	Dimethon	33						
Imidacloprid	Confidor , Grizly, Emereals	29						
Thiamethoxam	Actara, Final_ Flight	28						
Diazinon	Diazol, Diazate	39						
Bifenthrin	Brigade, GALIL, Biferan, Acetastar, Disect	30						
Carbosulfan	Marshall	48						
Permethrin	Ambush, Deraphon, Dragnet	33						
Chlorpyrifos	Bulldock star, Dursban, Pyrinex, Pyrinex quick	39						

Fungicide

Active Ingredient	Products	Number of countries banned	Health effects			Environmental effects		
			Cancer	Reproduction/ unborn baby	Nervous system	Pollination	Water/ Fish	Soil/ earthworm
Mancozeb	Ridomil-Gold, Victory, Ivory, Oshothane, Agrithane, Milthane, Biothane, Agrilax, many more.	31						

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Active Ingredient	Products	Number of countries banned	Health effects			Environmental effects		
			Cancer	Reproduction/ unborn baby	Nervous system	Pollination	Water/ Fish	Soil/ earthworm
Chlorothalonil	Dakota, Daconil, Katerina, Cherokee	34						
Propineb	Antracol	31						
Carbendazim	Goldazim, Soprano, Ransom, Chariot	34						
Epoxiconazole	Abacus-Advance, Ceriax, Rex-Duo, Osiris	30						

Herbicide

Active Ingredient	Products	Number of countries banned	Health effects			Environmental effects		
			Cancer	Reproduction/ unborn baby	Nervous system	Pollination	Water/ Fish	Soil/ earthworm
Paraquat	Herbstar, Parapaz, Gramoxone, Hurricane	58						
Atrazine	Perfecto, Primagram-Gold	44						
Glyphosate	Round-up, Twigasate, Highstop, Catapult, Kickout, Debar, Kalach	4						

Notes

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ABOUT THE HEINRICH BÖLL FOUNDATION, KENYA | UGANDA | TANZANIA

The Heinrich Böll Foundation (HBF) a non-profit organisation, is part of the global Green movement headquartered in Berlin Germany. The hbs tenets are anchored on ecology and sustainability, democracy and human rights, self-determination and justice. We place particular emphasis on gender democracy, meaning social emancipation and equal rights for all genders. HBF Nairobi office programme seeks to advance progressive political and socio-economic transformation through its thematic focus on Sustainable Development, Gender Democracy, Dialogue and Civic Spaces, Agroecology and Food Rights. To amplify our programme work, we support coordinated civic engagement and political/policy dialogues, research, publications and strategic communication.

You can find out more on https://ke.boell.org/en

ABOUT THE ROUTE TO FOOD INITIATIVE (RTFI)

The Route to Food Initiative (RTFI) is part of the Agroecology & Food Rights Programme at the Heinrich Boell Foundation, based in Nairobi, Kenya. We work to advance the right to adequate, sufficient, and healthy food. We champion Agroecology as a transformative solution—sustainable farming that incorporates ecological principles, minimizes harmful synthetic inputs, and fosters biodiversity. Through research, education, and advocacy, the development of resilient local food systems that empower small-scale farmers and communities to take control of their food production.

The Initiative employs innovative communication strategies to address challenges in food availability, access, and utilization. We work with mainstream and alternative media to educate, inform, spark dialogue, and promote discussions on food rights and the transformation of food systems

You can find out more on www.routetofood.org.

A copy of this report is available on the Route to Food Initiative & the Heinrich Böll Foundation website and can be ordered by emailing info@routetofood.org or ke-info@ke.boell.org

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