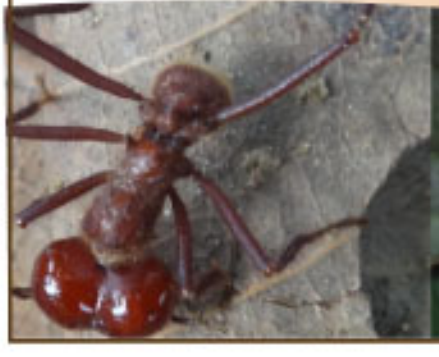
Ministry of Food Production

MANAGEMENT OF PESTS & DISEASES

A Home Gardener's Manual



Extension Training and Information Services Division

MINISTRY OF FOOD PRODUCTION

TRINIDAD AND TOBAGO

MANAGEMENT OF PESTS AND DISEASES

A Home Gardener's Manual

Extension Training and Information Services Division

Management of Pests & Diseases Manual

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Introduction

Congratulations on having your own home garden! This venture will provide you with fresh, healthy and safe food which will help you make and save money. There are many other rewards and health benefits to be gained from having your own garden. You can relax, reduce stress and enjoy watching your plants grow and produce.

As a home gardener, you may encounter a variety of problems caused by pests and disease organisms. This manual is designed to help you solve some of these problems.

Pests and diseases are organisms which threaten the life, quality and yield of a crop. These include fungi, bacteria, viruses, nematodes, insects, mites, snails and weeds. You must observe your plants regularly to detect the early signs of the presence of pests and diseases. This can save your plant from destruction. You must, however, correctly identify and treat the problem promptly.

This manual will help you to identify problems caused by some pests and disease organisms and guide you on how to manage them.

Pest and diseases may be managed by using a range of cultural, biological and chemical methods.

If you provide the right conditions for your plants, they will tolerate pests and diseases better. The manual highlights the use of cultural methods such as choice of crops, garden layout, seedling selection, mixed cropping, crop rotation, water management, moulding, mulching and weed control.

You will notice that we have focused on biological and cultural methods to encourage you to produce safe, healthy food.

This manual is divided into two sections:

Section 1 provides guidance on how to manage pest problems.

Section 2 will tell you how to manage a range of diseases that you may encounter.

Happy Gardening!

SECTION 1: HOW TO MANAGE PEST PROBLEMS

WHAT ARE PESTS?

There are many organisms that cause damage to crops. These are called pests and include insects, mites, slugs and snails. All of these can hinder plant growth, affect the yield and quality of produce and may even kill the plant. Insects are the most common plant pests.

Many insects multiply very quickly so it is very important to observe your plants regularly in order to detect the early signs of pest infestation. This can save your plant from destruction. You must, however, correctly identify and treat the problem promptly to prevent rapid population build-up.

Pests cause damage to plant roots, stems, flowers, fruits and seeds. Eaten, distorted or discoloured plant parts may be signs of insect damage. The nature of the damage is determined by the mouthparts of the insect. Generally insect mouthparts can be divided into three types; sucking, chewing and rasping/scraping.

If you observe any damage to plant, you should be able to determine the type of mouthpart and the pest that caused the damage ***(Table 1)***. Insects physically damage plants by chewing or scraping and also spread diseases from plant to plant.

Tip: ***Not all insects are harmful. Many insects are beneficial and actually help the gardener by pollinating flowers and by controlling pests.***

Table 1: Damage caused by insect mouthparts

MOUTHPART AND ACTION	DAMAGE	PEST
Rasping/Scraping • Plant tissue is rasped	Areas of discoloured tissue as if rubbed with sandpaper	Thrips Mites
Piercing/Sucking • Proboscis (elongated "beak") sucks up liquid	Small dots on the surface of fruits and leaves	Aphids Whiteflies
Chewing • Bite or tear plant tissue	Ragged edges of leaves Pieces of plant tissue missing	Caterpillars Beetles

METHODS OF CONTROLLING PESTS

There are various methods recommended to control pests in your home garden. These include cultural, biological and chemical control. A successful gardener will use a combination of control methods to properly manage pest problems. This approach is known as ***integrated pest management (IPM).***

◆ Cultural Practices - Cultural methods include mixed cropping, crop rotation, proper drainage, spacing, weeding, moulding, mulching, staking, and pruning. If you practice these methods, you will prevent pests from finding places to hide in the garden.

- ***Weed Control*** – A weed is a plant growing where it is not wanted. Control weeds since they compete with your crops for sunlight, nutrients, water and space. They also create an environment for pests to live.

- ***Mixed Cropping*** – Mixed cropping is the planting of different types of crops in the same area. It is one of the most effective cultural practices.

- Pests become confused and find it difficult to adapt to different types of plants in the same area ***(Table 2)***.

- ***Crop Rotation*** – In crop rotation, the same crop is **not** planted in the same area, season after season. Crops from different crop families ***(Table 3)*** are planted in the same area.

For example, if a legume (peas) is your first crop, then you can plant a leafy vegetable (lettuce) as your second crop on the same spot, followed by a fruit crop (tomato), then a root crop (sweet potato).

Table 2: Crops that can be planted together

VEGETABLE	COMPANION CROPS
Beans	Cucumber, cauliflower and cabbage
Cabbage, cauliflower and broccoli	Celery, dill, rosemary and beet
Celery	Tomato, cauliflower and cabbage
Corn	Peas, beans, cucumber, pumpkin and squash
Cucumbers	Beans, corn and peas
Melongene	Beans
Lettuce	Radish and cucumber
Peas	Radish, cucumber, corn and beans

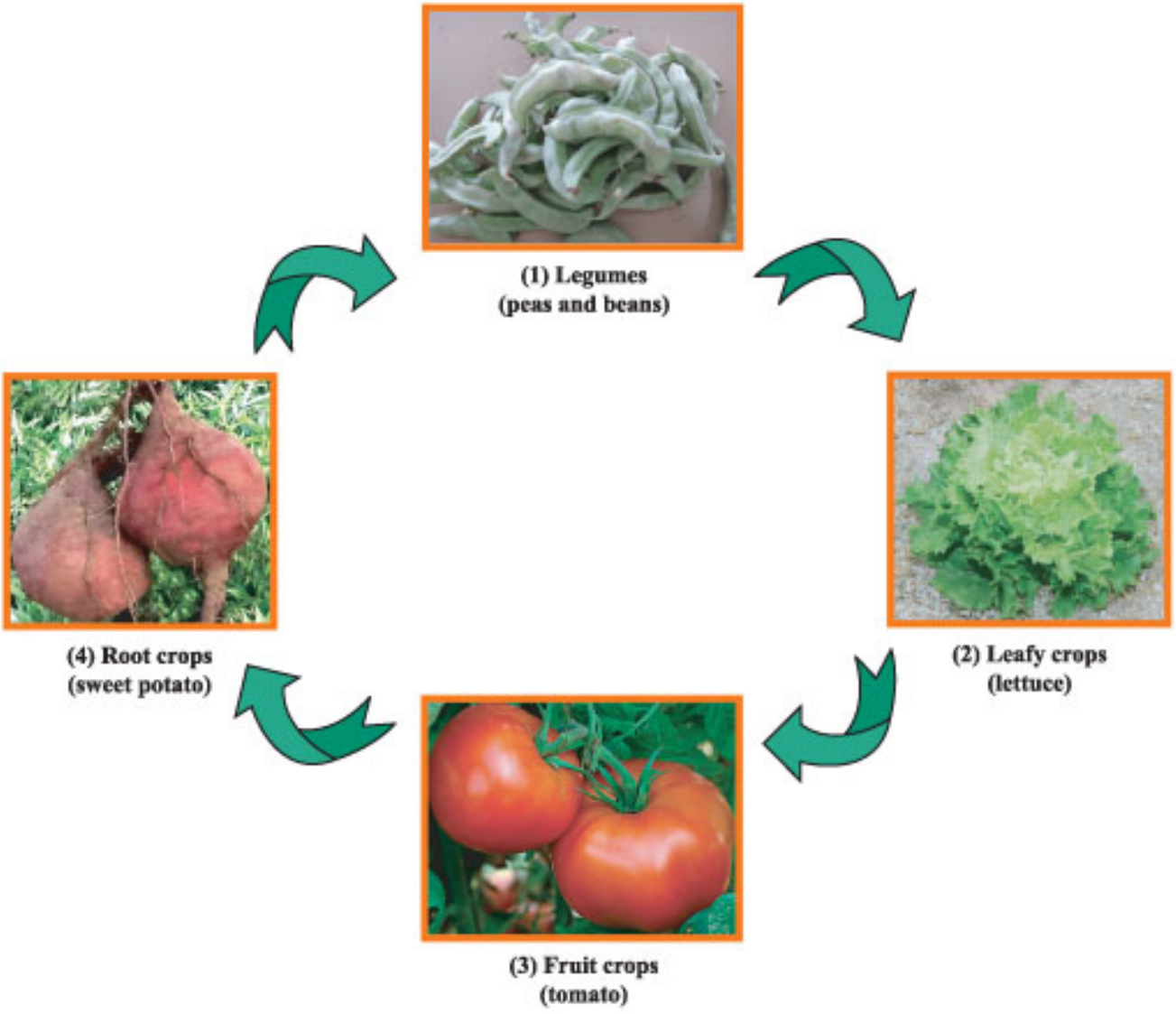


Figure 1: Example of Crop Rotation

Note: Crop Rotation is also very effective in improving soil fertility and preventing pest build up.

Use ***Table 3*** (below) as a guide to crop families for crop rotation.

Table 3: Crop Families

CROP FAMILY	CROPS
Alliaceae	Onion, shallot, leek
Amaranthaceae	Bhagi
Brassicaceae/Cruciferae	Cabbage, cauliflower, broccoli, radish, mustard
Chenopodiaceae	Beetroot, spinach
Compositae	Lettuce, sunflower
Convolvulaceae	Sweet potato
Cucurbitaceae	Cucumber, pumpkin, squash
Gramineae	Corn
Labiateae	Basil
Leguminosae	Peas, beans, peanuts
Malvaceae	Ochro, sorrel
Solanaceae	Tomato, potato, pepper, melongene
Umbelliferae	Carrot, parsley, celery, dill, fennel

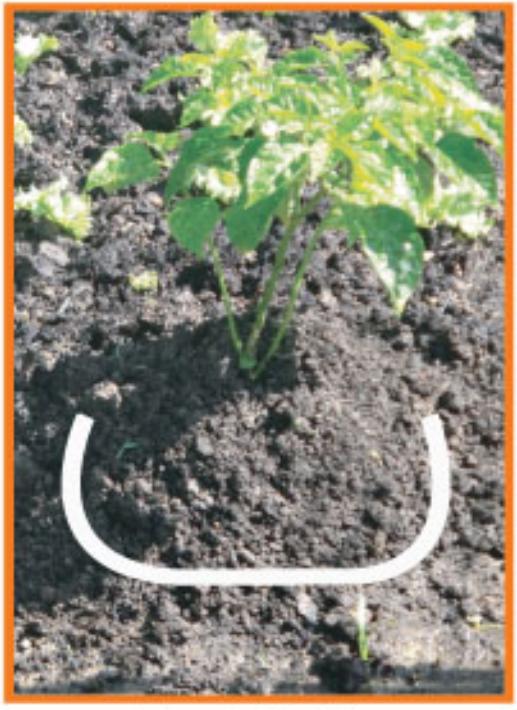


Figure 2: Moulding

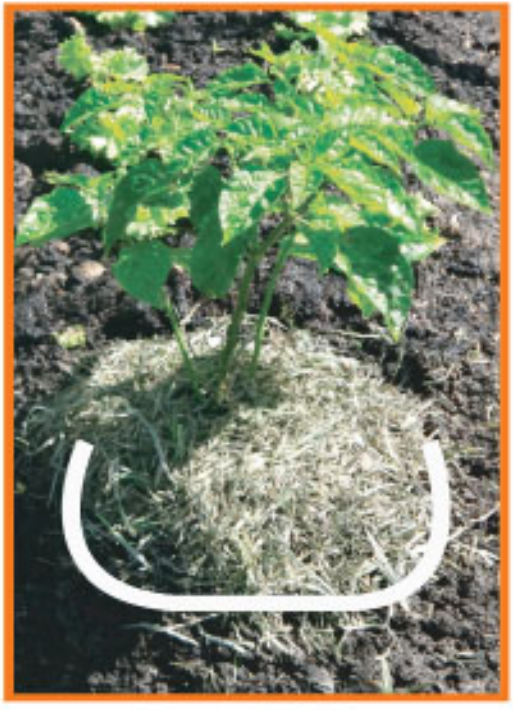


Figure 3: Mulching

• **Moulding** - You can also mould your plants, by forming a gentle mound of soil around the plant base. This will encourage proper drainage, proper root development and help control soil pests and weeds.

• **Mulching** - Mulching involves the use of materials, such as dried grass, to cover the soil around the plants. This will also reduce weed growth, conserve soil moisture, control some pests and reduce some diseases spread by soil splash.

◆ Biological Control - There are a number of living organisms in the garden that can be used to manage pests. The use of one living thing to control another is called **biological control**. Aphids, caterpillars, mealy bugs and beetle larvae can be effectively controlled by ladybird beetles.

Encourage other beneficial organisms for example, wasps, frogs, spiders and other insects. These will help control pests in the garden.

Practice companion planting to encourage beneficial organisms in your garden and keep away harmful insects.

◆ Use of Pesticides – Chemicals can be used to manage pests. However many chemical pesticides are very toxic and should not be used in the garden.

Use environmentally friendly pesticides. Biological pesticides are recommended as they are derived from natural plant or animal sources.

Many common household products can also be used to control pests. Some of these products are outlined in ***Table 4.***

Natural enemies

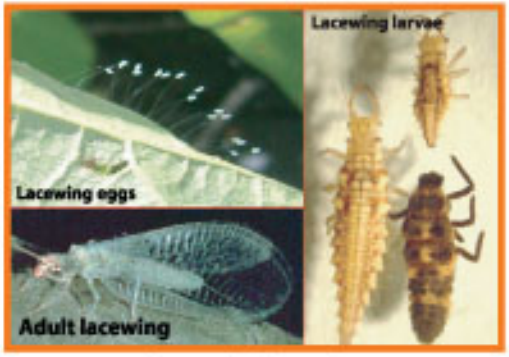


Figure 4: Lacewing (*Chrysopidae sp.*)

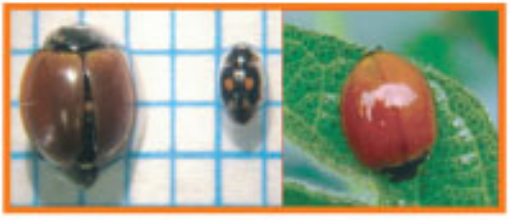


Figure 5: Ladybird beetles

Figure 6: Wasp pulling spider

Table 4: Some Examples of Natural Pesticides

NATURAL PESTICIDE	RECOMMENDATIONS
Wood Ash This can be used as a powder or in solution to control both soft-bodied and sucking insects.  **Figure 7: Wood Ash**	• Apply as mulch to deter insects, slugs, snails and nematodes. • Dip planting materials and cuttings in dry ash to prevent diseases. • Spray a mixture of wood ash and soap solution to protect plants from flea beetles, mites and stink bugs. • Mix the following ingredients together and allow to soak for several hours. ▹ ½ cup wood ash ▹ ½ cup agricultural lime ▹ 4 litres water • Filter and spray crops. Very effective against sucking pests and cucumber beetles.
Red peppers Apply as powder, liquid or with other ingredients to offer protection against many insects and diseases  **Figure 8: Red Pepper**	• Sprinkle red pepper powder at the base of the plant or on dampened plants to deter many pests. • Liquid sprays can be prepared by using 5 grams of crushed, chopped or dried peppers to 6 litres of water. Boil or soak overnight; filter and dilute before using.

Table 4: Some Examples of Natural Pesticides *(cont'd)*

NATURAL PESTICIDE	RECOMMENDATIONS
Neem This can be used as neem sprays, neem oil, and neem cake to provide protection against a wide range of plant pests.  **Figure 9: Neem plant** *(Azadiriachta indica A. Juss)*	• ***Neem spray*** - mix 50 grams of crushed neem seed in 1 litre of water and leave for 12 to 24 hours. Apply every 10 – 15 days if required. • ***Neem oil*** - use 1 kg of neem seed powder in water to make a paste. Alternatively knead and squeeze paste to extract about 100 - 150 ml of neem oil. The remaining solid is neem cake. • ***Neem cake*** - adding 1 - 2 kg of neem cake to 10 square metres of soil reduces nematode infestation.
Milk Diluted sprays are effective against spider mites, kills caterpillar eggs in crucifer family and prevents fungal and viral diseases.  **Figure 10: Milk**	• Mix thoroughly: ➢ 1 litre of milk ➢ 9 litres of water Spray every 10 days if required.

Table 4: Some Examples of Natural Pesticides *(cont'd)*

NATURAL PESTICIDE	RECOMMENDATIONS
Garlic Garlic can be used to control a wide range of insects and some diseases.  **Figure 11: Garlic**	• Garlic spray solution is prepared by using 1 crushed bulb in 1 litre of water. Add 1 tablespoon soap solution and use immediately. • Do not use on legume crops since the strong taste will persist for some time. • Garlic is also effective when used in combination with red peppers, onion and marigolds.
Marigolds Marigold sprays deter a wide range of insect pests and control certain plant diseases.  **Figure 12: Marigold**	• Make a marigold mixture and use as follows: - Crush 150 grams of leaves, flowers and roots. - Pour 1 litre of hot water and allow to soak for 24 hours. - Add 1 litre of water to the mixture and spray directly on plants or mix into the soil. ***This spray can also be used in combination with onion, garlic and red peppers.***

Table 4: Some Examples of Natural Pesticides *(cont'd)*

NATURAL PESTICIDE	RECOMMENDATIONS
Miscellaneous plants/products  **Figure 13: Miscellaneous**	Many plants have been cited as having pesticidal properties. These include soursop, Barbados nut (physic nut), basil, castor oil, crotalaria, eucalyptus, papaya, soyabean, sweet potato, tamarind, tobacco and tomato. Other materials also cited as having pesticidal properties are baking soda, powdered clay, powdered limestone, flour, well-cured manure, soap, sulphur and vegetable oil.

Common Pests seen in the Home Garden

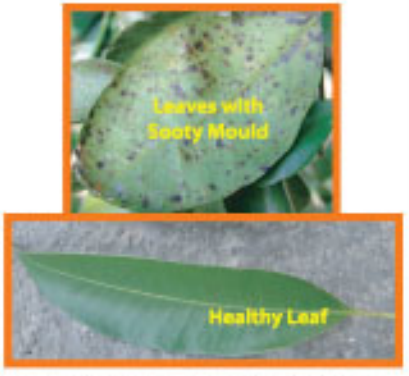
The following pests are commonly seen in the home garden.

- Ants
- Aphids
- Armyworm
- Bachac
- Budworm
- Cabbage Looper
- Cucumber Worm
- Cut Worms
- Ear Worms
- Leaf Miner
- Mealybugs
- Mites
- Mole Cricket
- Snails and Slugs
- Stink Bugs
- Thrips
- White Flies

Table 5 which follows shows possible ways of controlling those pests.

Table 5: Management of Common Pests in the Home Garden

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Ants (excluding bachacs) Family : Formicidae  **Figure 14: Ants' nest**  **Figure 15: Ants**	• A mound of soft, dry earth on top of the soil indicates the presence of an ants' nest. • Ants become a problem when they form nests close to the plant roots. • Wilted plants - Ants damage roots and reduce the uptake of water and nutrients causing your plants to wilt. • Damage to flowers and young fruits. • Ants can be a nuisance and can bite you. • The presence of ants on your plants can also be a sign of other problems such as mealy bug and aphids. The most common ant that will cause problems are bachacs (***see Figures 23 & 24***).	• Wrap adhesive tape around the base of the plant with the sticky side facing out. This will keep ants from getting onto the plant. Replace the tape when it becomes covered with ants. • Apply petroleum jelly at the base of plants to prevent ants from climbing up the plant. • Locate and destroy nests.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Aphids  **Figure 16: Aphids on Melongene leaf** Aphids are small (2-4 mm), oval-shaped insects found on the underside of young leaves and growing plant parts. They are brown, black, green or yellow in colour. Mouthparts are adapted for piercing and sucking sap from plants.	• Presence of ants. • Distorted young leaves which curl upwards on leaf margins. • Aphids secrete a sugary substance called honeydew that encourages the growth of Sooty Mould (a black fungus).  **Figure 17: Sooty Mould on leaf** (healthy leaf vs sooty mould on leaf) • Aphids spread viruses from one plant to another. • Plants eventually die.	• Remove and destroy heavily infested shoots. • Use biological control methods. Do not destroy the ladybird beetles. They feed on aphids. • Use overhead irrigation. This will wash off the aphids.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Armyworms *(Spodoptera sp)*  **Figure 18: Larval stage (caterpillar) of Armyworm** • Affects most vegetable crops. Larvae are smooth, striped and almost hairless. • Larval mouthparts are adapted for biting and chewing. • Armyworm caterpillars are most active at night and eat almost everything in their path. • Adult is a light brownish grey moth.  **Figure 19: Adult stage of the Armyworm**	• Large irregular holes in the leaves.  **Figure 20: Damage on leaves** • In severe cases leaves are eaten and only the veins remain.  **Figure 21: Severe attack on cabbage** • Frass on leaves.  **Figure 22: Holes and Frass (insect droppings) on leaves**	• Practice cultural control e.g., crop rotation. • Control weeds. • Use biological control - Do not kill wasps. They can feed on larva.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Bachacs   **Figure 23: Bachacs** • Bachacs have cutting mouthparts	• Semi-circular bites at the edges of the leaves.  **Figure 24: Bites on leaf edge**	• Use bachac baits. • Locate and destroy nests. • Use petroleum jelly at the base of plants to prevent bachacs from climbing up. • Soak castor oil leaves and seeds in water for 1 day. Then filter and spray on plants. • Use dry castor oil seeds and leaves. Crush into a powder and sprinkle on plants.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Bud worms *(Hellula sp)*  **Figure 25: Picture of budworm** • The eggs are laid on the upper leaves of plants in the seedling stage • Budworm damage is common in cabbage and cauliflower (Crucifer family).	 **Figure 26: Damage on young growing point and leaves** • When the growing point is damaged, the plant usually responds by: ▹ forming smaller lateral, unmarketable heads. ▹ becoming stunted	• Remove and destroy larvae. • Practice cultural control such as crop rotation and mixed cropping. • Use biological pesticides. • Encourage wasps.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Cabbage Loopers *(Trichoplusia ni)*  **Figure 27: Cabbage Looper** • This is a larva (caterpillar) that moves with a characteristic "looping" action.	 **Figure 28: Holes in leaves** • Holes in leaves • Brown frass (insect droppings) on leaves	• Do not destroy beneficial insects such as wasps. • Use biological pesticides. • Plant seasoning herbs since the pungent smell keep pests away. • Dust ash on leaves and around the base of plants. This is very effective in destroying insect eggs and loopers.
Cucumber worms *(Diaphinia sp)*  **Figure 29: Cucumber worm** • This is the larvae of the striped cucumber beetle that tunnels into cucumbers and pumpkin leaving "frass" at the entry point.	 **Figure 30: Cucumber worm damage** • Holes on cucumber • Frass at entry point • Tunnels inside cucumber	• Use biological pesticides. • Use cultural practices such as mixed cropping and crop rotation. • Dust ash on leaves and around base of plants.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Cutworms  **Figure 31: Cutworms** • Cutworms are smooth, soft-bodied, plump yellowish-green caterpillars. They are larva of different types of moths and are usually found in the soil. • The adult moths are generally dark brown or black striped moths. • Moths lay eggs on the leaves or on moist ground.	 **Figure 32: Cutworm damage on a seedling plant** • Cutworms encircle the base of young plants and cut through them at soil level • One cutworm can cut several seedlings each night. They also feed on leaves and soft tissue.	• Place a stick next to plant to prevent the cut worm from wrapping around the plant. • Sprinkle agricultural lime, flour or ash around the base of plants to prevent insects from laying eggs. • Prepare the following mixture: ▹ 1 tablespoon dishwashing liquid ▹ 1 cup vegetable oil **Mix well** Add 2 tablespoon of this mixture to 1 cup of water. Loosen soil around plants and drench with this mixture.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Earworms *(Heliothis sp)*  **Figure 33: Larva**  **Figure 34: Adult** • Larvae vary in colour from green to brown	• Holes on fruit. The holes turn brown and rot.  **Figure 35: Holes in tomato fruit** • Frass seen on plants  **Figure 36: Frass on corn**	• Control weeds. They provide food and shelter for pests • Remove pests by hand • Prepare and spray with the following mixture: ▹ Mix one heaped tablespoon of wood ash with 1 litre of water and allow the mixture to stand overnight. ▹ Strain and add one cup of milk to the liquid. ▹ Add one cup of the mixture to three cups of water before spraying.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Earworms *(Heliothis sp)* (cont'd) • They damage fruits of a range of vegetable crops (for example tomato, pigeon peas and corn). • Eggs are laid on the upper part of the plant close to the growing points.	 **Figure 37: Earworm damage to corn silk** • Damaged corn silk	• Sprinkle wood ash in the heart of the plant. Larvae will not survive in this dry condition. • Remove by hand. • Use overhead irrigation to wash away some of the larvae. • Practice Biological Control. Do not destroy wasps - they feed on the larvae.
Leaf miner *(Liriomzya sp)* • Adult leaf miners are about 2 - 4 mm long and they lay their eggs on leaves. The eggs hatch into larvae which make tunnels between the upper and lower leaf surfaces as they feed.	 **Figure 38: Leaf miner damage on a bodi leaf** • A whitish/silvery trail which eventually turns brown.	• Control weeds since they provide food and shelter for the pest. • Destroy infected leaves. • Spray the plant with neem oil. It prevents the pest from feeding on the plant and interferes with egg laying.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Mealy Bugs  **Figure 39: Mealy bugs** *(Macronellicoccus hirsutus)* • Mealy bugs feed on the soft tissues of many fruits and vegetables. • Adult mealy bugs are small (about 3 mm long) and have a white cottony appearance. • The pink Hibiscus mealy bug attacks all plants but mainly hibiscus, sorrel and ochro. When the adults are crushed their body fluids are also pink.	 **Figure 40: Rosetting** • Ants may indicate the presence of mealybugs. • Curled and crinkled leaves caused by the toxic saliva when the insect feeds. The curled leaves can resemble viral damage. • Rosette-like appearance (bunchy heads of small bushy leaves) at the growing points. • Deformed buds and fruits. • Stunted plant growth. In severe cases, plants die.	 **Figure 41: Ladybird beetle** *(Cryptolaemus montrouzieri)* • Remove and destroy infected plant parts. • Practice Biological Control - Do not destroy Ladybird beetles. They feed on all stages of the hibiscus mealybug. **Note: Ladybird beetles and *Anagyrus kamali* wasps were used in a biological control programme for the Hibiscus mealy bug outbreak in Trinidad and Tobago.**

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Mites  **Figure 42: Mite** • These are tiny (0.5 mm) creatures with eight legs • They are usually found on the underside of leaves and are more common in the dry season.	 **Figure 43: Narrow curling downward drooping leaves** • Narrow, curled, wilted leaves which droop downwards. • Leaves appear bronze in colour. • Brown, rough spots on leaves, flowers and fruits. These spots become dry, brittle and cracked. • Flower drop • Early fruit drop • Low yields	• Use overhead irrigation. This will wash away the mites. • Do not plant in shaded areas. Mites multiply rapidly under these conditions. • Prepare neem solution and spray plants. • Prepare and spray plants every 10 days with the following solution: ▹ 1 tablespoon dish washing liquid ▹ 1 cup of vegetable oil ▹ 1cup of water Mix thoroughly and use 1 table-spoon of this mixture in 3 litres of water .

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Mole Crickets  **Figure 44: Mole cricket** • Mole crickets have enlarged forelegs that are used for digging in the soil. These insects cut young plants at soil level and then pull them underneath to be eaten.	• Girdled seedlings (bark removed) at the stem near the soil surface. • Severed plant.	• Drench soil with soap water containing lemon or lime. • Do not kill frogs and toads since they feed on mole crickets. • Use mole cricket baits • Use biological pesticides

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Snails and Slugs  **Figure 45: Snail (has shell)**  **Figure 46: Slug (does not have shell)** • They feed at night on a variety of young plant tissues (leaves and bark), ripening fruits and decaying plant matter.	 **Figure 47: Irregular holes with smooth edges** • Irregular holes in leaves. • A silvery mucous trail is left wherever slugs and snails pass	• Remove and destroy snails and slugs. • Sprinkle ash around the plants to destroy slugs and snails. • Do not kill frogs. They feed on slugs and insects. • Pour beer in containers and place at soil level throughout the field. Slugs and snails would be attracted to the beer, fall into it and drown. • Use drip irrigation since it will reduce the humidity.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Stink Bugs  **Figure 48: Stink Bugs** • Stink bugs attack a variety of fruits and vegetables. • When disturbed, they have a characteristic scent. This protects them from being eaten by birds and beetles.	• Dark pin-point sized punctures on fruits. • In tomato the punctures become white and pithy. The fruit, however, remains firm as it ripens.	• Remove and destroy stink bugs. • Remove weeds because they provide food and shelter for pests. • Plant seasoning herbs in the garden. The scent of these plants keeps away the stink bug.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Thrips *(Thrips palmi)*  **Figure 49: Immature Thrip (highly magnified)** • These are tiny, yellow or green insects (1 - 3 mm) that are more common in the dry season and are usually found on the underside of leaves. • They suck the sap of a wide range of vegetable crops such as pumpkin, melongene and peppers.	 Scarred Fruit **Figure 50: Thrips damage on melongene** • Upward curling of leaves • Mottling of leaves • Bronzing of young leaves • Deformed leaves, flowers and fruits • Scarred fruits • Flower drop • Stunting of plants • Reduced yields	• Control weeds since they provide food and shelter for pests • Use overhead irrigation. This will wash away the pests • Practice crop rotation • Mulch plants. • Spray plants with neem solution. • Dust wood ash onto leaves • Stir 2 tablespoons of liquid soap into 5 litres of water and spray plants.

PESTS	SYMPTOMS OF DAMAGE	MANAGEMENT
Whiteflies  **Figure 51: Whiteflies** ***(magnified photo on left)*** • Whiteflies are tiny insects which are easily visible when plants are disturbed. • They spread viruses which reduce production. Tomato plants are more severely affected than other plants.	White flies spread viruses from one plant to another. Most of the symptoms observed are those of viral infection. • Deformed (crinkled and stunted) growing points. • Yellowing of leaves. • Deformed and discoloured fruits.	• Use overhead irrigation. • Spray plants with neem solution. • Stir 2 tablespoons liquid soap into 5 litres of water and spray plants.

A good manager is always on the lookout, trying to get the best production from his/her crop. The identification of potential problems, timely and appropriate control measures and provision of the conditions required for growth, will ensure a successful crop.

The next section will inform you about diseases in plants and how they reduce the plants' ability to become good producers.

SECTION 2: HOW TO MANAGE DISEASE PROBLEMS

PLANT DISEASES

All plants are subject to attack by micro-organisms that could adversely affect their growth. When these micro-organisms invade the plant cells causing undesirable symptoms, the plant is said to be diseased. Some of the symptoms of disease attack include yellowing, stunting, leaf-curling, spotting, rotting, wilting and falling over. Fruits may be fewer, smaller than usual, malformed and irregularly coloured.

Plant diseases are mainly caused by bacteria, fungi, viruses, nematodes and oomycetes. These micro-organisms are everywhere yet most plants do not become diseased. This is because three conditions must be present in order for infection to take place:

- The micro-organism
- The host plant and
- The correct environmental conditions.

- The source of the disease causing micro-organisms, referred to as the inoculum, can be controlled by removing all residues of the previous crop from the garden.
- The host plant must be strong and properly fertilized in order to resist becoming diseased.
- As a home gardener, you can make the environment unsuitable for disease development by engaging in recommended cultural practices.

These cultural practices include drainage, spacing, weeding, moulding, mulching, staking and pruning:

- **Drainage** makes the environment unattractive to micro-organisms by removing excess water.
- **Proper spacing, pruning, weeding** and **staking** reduce humidity in the field and discourage growth of micro-organisms.
- **Moulding** helps to anchor the plant.
- **Mulching** reduces diseases spread by soil splash, reduces weed growth, prevents drying of the soil and can control some insect attacks.

COMMON DISEASES IN THE HOME GARDEN

Diseases may develop on any part of the plant (fruits, leaves, stems, roots and even the entire plant). Some common diseases that occur in the home garden include:-

Diseases in Fruits

- Sunken Spots
- Water-soaked Spots
- Dry Spots
- Blossom-End Rot

Diseases in Leaves

- Dry Spot
- Rust
- Angular Spots
- Black Leaves
- Viruses
- White Powdery leaves
- Round Leaf Spots

Diseases in Stems

- Stem Rot
- Oozing Stems
- Bacterial Wilt
- Nematodes

The following table shows some of these diseases, describes the symptoms and recommended management practices.

Table 6: Diseases in Fruits

PROBLEM	DISEASES SYMPTOMS AND AFFECTED CROPS	MANAGEMENT
Sunken Spots  **Figure 52: Tomato with *Anthracnose* (fungus)**	• Brown sunken spots • Classic "bullseye" appearance • Can occur while fruit is developing but most common after fruit is harvested • Affects tomato, melongene, pepper, pumpkin, bodi, cucumber, pawpaw and mango	• Dry fruits before storing • Avoid harvesting when it is raining
Water Soaked Spots  **Figure 53: Melongene with *Erwinia* (bacteria)**	• Raised spots with a distinct water soaked appearance. • Affects tomato, pepper, paw paw and melongene. • Symptoms appear after harvest.	• Dry fruit before storing

PROBLEM	DISEASES SYMPTOMS AND AFFECTED CROPS	MANAGEMENT
Dry Spots  **Figure 54: Bacterial Speck and Spot** *Psuedomonas sp. and Xanthomonas sp. (bacteria)*	• Small dry spots scattered all over the fruits • The spots are larger in Bacterial Spot and smaller in Bacterial Speck. • Affects tomato	• Mulch soil. • Use limestone if soil is acidic.
Blossom-End Rot This is not a disease but a disorder caused by: ▹ insufficient calcium and ▹ irregular watering  **Figure 55: Blossom End Rot in Tomatoes**	• Dark sunken spots that form at the bottom of the fruit • Affects tomato, pepper and melongene	• Apply calcium to strengthen cell walls. • Ensure the plant gets enough water regularly. • Do not allow periods of excessive or lack of water.

Table 7: Diseases in Leaves

PROBLEM	DISEASES SYMPTOMS AND AFFECTED CROPS	MANAGEMENT
Dry Spot  **Figure 56: Common blight symptoms on bodi** *Psuedomonas sp. and Xanthomonas sp. (bacteria)*	• Begins as water-soaked spots on leaves • Area surrounding spots may become yellowish-brown and brittle. • Pods have small watery spots which enlarge to irregular blotches, then later become brown, sunken and dry. • May spread to fruit (check bacterial spot & speck) • Affects bodi, pigeon peas, seim.	• Use limestone if soil is acidic. • Mulch.
Rust  **Figure 57: Rust on corn leaves *Puccina sp (fungus)*** • Spread by rain splash, wind and animals. • Hot, humid, stagnant conditions encourage rust.	• Characterized by small, red to reddish-brown pustules on under-sides of leaves • Serious problem on beans, pigeon peas, seim, bodi and corn	• Remove leaves and burn.

PROBLEM	DISEASES SYMPTOMS AND AFFECTED CROPS	MANAGEMENT
Angular Spots  **Figure 58: Downy Mildew on tomato leaf** *Peronospora sp. (fungus)* *Bremia sp(fungus)*	• Yellowish, straight-sided spots on upper leaf surface. Older outer leaves are affected first with the infected areas turning brown. • Off-white to purplish furry growth appears on lower leaf surfaces corresponding to the discoloured patches on the top of the leaves. • Affects cucumber, pumpkin, squash and carailli. • Plants of all ages, may be affected.	• Prune to increase air flow in the garden. • Remove and burn all affected leaves.
Black Leaves  **Figure 59: Sooty Mould on an orange leaf** *Capnodium sp.(fungus)*	• Leaves are covered by a black film. • Ants may be present. • Caused by sap sucking insects which excrete the honeydew onto the surface of the leaves. This honeydew provides energy for the fungus to grow. • Affects pepper, bodi, pigeon peas, citrus and melongene.	• Control aphids and whiteflies (sap-sucking insects). • Apply soap water to the affected leaves.

PROBLEM	DISEASES SYMPTOMS AND AFFECTED CROPS	MANAGEMENT
Viruses  **Figure 60: Virus Infected pepper plant**	• Leaf curling • Stunted plants • Deformed leaves and stems • Leaf veins become lighter in colour than surrounding leaf tissue; this is called vein clearing	• Control the vectors: whiteflies and aphids. • Apply magnesium sulphate (Epsom salts) to help plant to outgrow the virus. • In severe cases, uproot and remove infected plants from the garden.
White Powdery Leaves  **Figure 61: Cucumber with Powdery Mildew** *Podosphaera sp. (fungi)*	• White powdery fungal growth on the upper surfaces of leaves. • Symptoms may spread to the lower leaf surfaces and to other plant parts including the fruit. • Caused by a variety of fungi each affecting a different family of plants but is most commonly seen in the gourds (cucumber family).	• Avoid overhead irrigation. • Increase air flow in the garden by pruning or growing plants on trellises. • Plant resistant varieties.

PROBLEM	DISEASES SYMPTOMS AND AFFECTED CROPS	MANAGEMENT
Rounded Leaf Spots  **Figure 62: Pumpkin leaves showing symptoms of** *Cercospora sp.(fungi)*	• Starts as tiny circular or oval spots on leaves which enlarge with time. • Spots are dark green to brown with or without maroon or purple margins. In later stages, the leaves dry out and die completely. • Found on lettuce, celery, tomato, pepper, cabbage and melongene.	• Avoid overhead irrigation. • Increase air flow in the garden by pruning and staking.

Table 8: Diseases in Stems

PROBLEM	DISEASES SYMPTOMS AND AFFECTED CROPS	MANAGEMENT
Stem Rot  **Figure 63: Tomato plant affected by** *Phytophthora sp. (oomycete)*	• Water-soaked black lesions on stems, leaves, and roots. • Poor growth and wilting of the entire plant. • Plants begin to die from the tips. • If the disease infects the fruits, they will rot and be unusable. • Fruit may appear healthy but can be diseased on the inside. • Affects pepper, melongene and tomato.	• Ensure there is adequate drainage. • If *Phytophthora* shows up in an area in the garden that drains into another part, it is advisable to abandon the lower area since the infection is guaranteed to spread.
Oozing Stems  **Figure 64: Gummy Stem Blight in watermelon** *Didymella sp.(fungi)*	• Water-soaked lesions on leaves and stems. • Spots turn dark brown and produce a brown sticky exudate. • Lesions may enlarge to girdle stems. • In severe infections, fruits are affected and may split. • Affects members of the gourd family: squash, carailli, pumpkin and cucumber.	• Hot, humid, poorly ventilated conditions encourage this disease. • Avoid overhead irrigation. • Do not water plants later than 3:00 p.m. since this would encourage overnight humidity. • Increase air flow in the garden by staking.

Table 9: Diseases that affect the Entire Plant

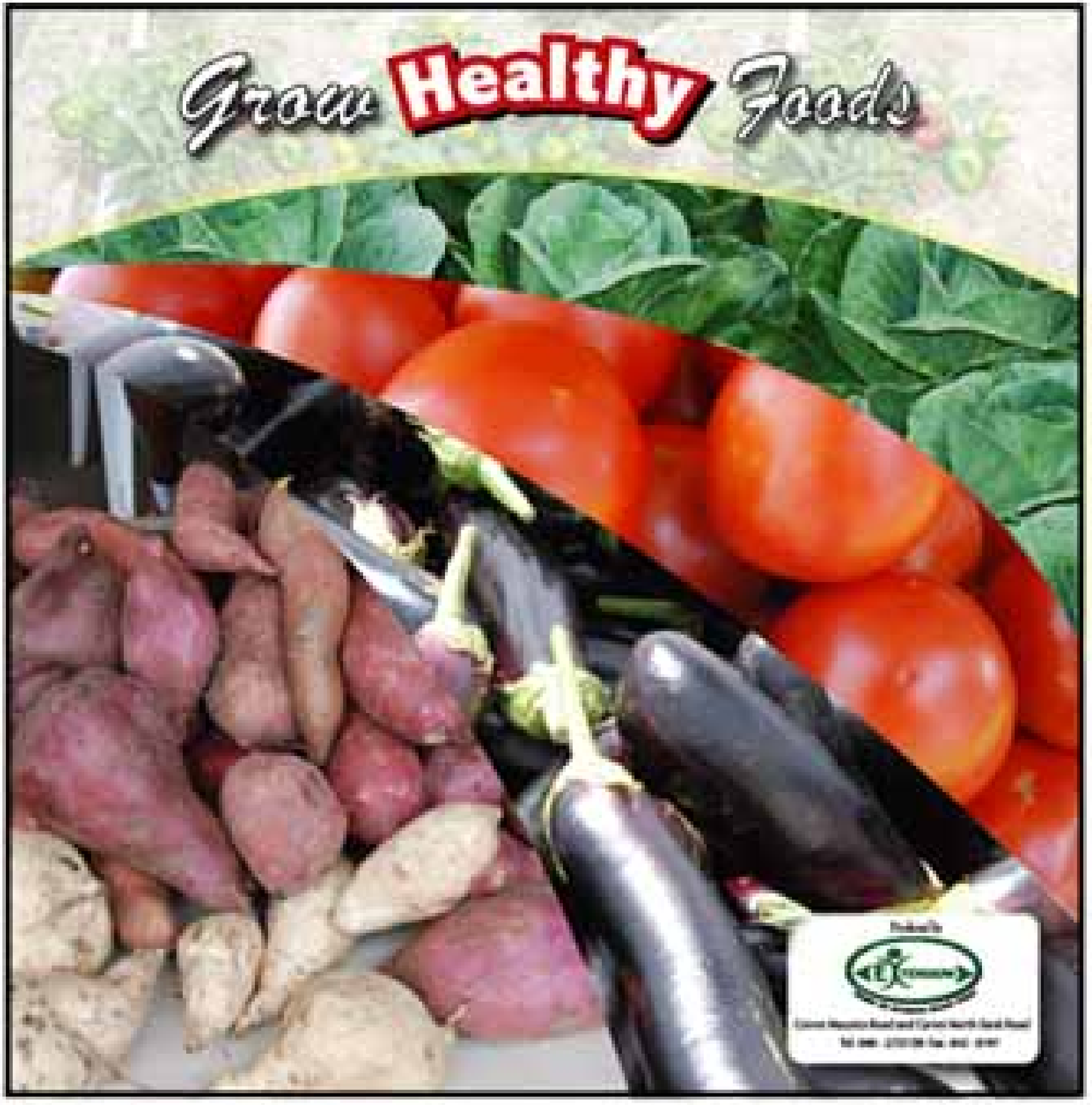
PROBLEM	DISEASES SYMPTOMS AND AFFECTED CROPS	MANAGEMENT
Bacterial Wilt  **Figure 65: Bacterial Wilt in Tomato** *Ralstonia sp. (bacteria)* *Erwinia sp. (bacteria)*	• Plant starts to wilt from the top and eventually entire plant wilts and dies. • Plants of all ages can be affected but this disease is most common in plants that are mature and flowering. • Common disease in tomato.	• Plant resistant varieties. • Use limestone if soil is acid. • Ensure there is adequate drainage.
Nematodes  **Figure 66: Characteristics swellings of Root-knot Nematode** *Meloidogyne sp.*	• Entire plant wilts. • Stunted plants. • Reduced yield both in terms of fruit size and fruit number. • Numerous galls on the roots affect the plant by restricting uptake of water and nutrients. • All field crops, forage crops and common vegetables are susceptible to some species of root knot nematode.	• Plant marigold throughout the garden.

CONCLUSION

While all home gardens will be affected by pest or disease problems, none will be affected by all of the problems outlined in this manual. Do not let the risk of pests or disease attack dissuade you from planting a garden. The rewards are greater when you can surmount these challenges.

Many cultural approaches can reduce or even remove the threat of a problem. Encouraging beneficial insects can provide you with a 'police force' that is eager to whisk away potential threats. Proper sanitation including clearing away the waste of a previous crop will further protect your garden. If, inspite of all your precautions, your crop does succumb to an attack there are many safe natural pesticides you can use to produce a healthy crop.

Take precautions, follow cultural guidelines encourage beneficial insects, properly identify problems and plant boldly. You will truly eat the fruits of your labour.


Grow Healthy Foods