

Identifying Pests and Diseases



OVERVIEW

LEARNING OBJECTIVE

Participants will be able to identify common pests and diseases in their home gardens.

MATERIALS NEEDED

- Flipchart
- Many colors of markers, especially yellows, browns, greens, for drawing insects
- Paper for participants
- Tape
- Insect pests collected by gardeners (optional)
- Insect-damaged leaves and other plant parts (optional)








DURATION



KEY CONCEPTS

- When plants are sick or in distress, they express symptoms that help gardeners understand what is wrong.
- Different kinds of pests create different kinds of damage. Learn which pests are affecting your garden!
- Through early control of pests and diseases, gardeners can promote good garden health and prevent future attacks.

TRAINING AGENDA

1	Introduction and warm-up	 DISCUSSION	10 min
2	What is wrong with my plants?	 DISCUSSION	30 min
3	Understanding insect pests	 DISCUSSION	45 min
4	Beneficial insects and plants that attract them	 DISCUSSION	30 min
5	Insect pest life cycles	 DISCUSSION	30 min
6	Understanding and managing plant diseases	 DISCUSSION	45 min
7	Closing discussion	 DISCUSSION	15 min

1. Introduction and warm-up

Welcome gardeners to the training. Do a brief introduction to today’s topic and review the training agenda. You may want to outline the training agenda on your flipchart or board so gardeners can see it when they arrive.

Conduct a warm-up exercise or ice-breaker to make sure all gardeners feel welcome and are ready to fully participate. Suggested warm-up and ice-breaker activities can be found in the Facilitator’s Guide: Encouraging Learning through Participant Engagement.

2. What is wrong with my plants?

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners will learn how to observe plant “symptoms” to determine if plants are suffering from nutrient deficiencies, water stress, insect damage, or a disease.

MATERIALS NEEDED: Flipchart and markers

1. Explain to gardeners that when something is wrong with plants, they will start to show “symptoms,” or signs of a problem. Have gardeners list symptoms they commonly observe in plants. Start with the most common symptoms and move to the rarer ones.
2. Divide your flipchart paper or board up into four sections for nutrient deficiency, water stress, insect damage, and diseases. Discuss with gardeners which symptoms are most commonly associated with what problem.

KEY MESSAGES

Although it is not always easy to determine exactly what is wrong with a plant, gardeners can look for these common symptoms to better understand how to fix a problem.

When plants remain untreated, a small problem may cause other more serious problems to develop. For example, a plant that has just a few whiteflies on it will appear fine at first, but, if left untreated, the whiteflies will reproduce very rapidly until they cover the plant’s leaves. When whiteflies suck on plant tissue, they can transmit certain viral diseases that cause leaves to become yellowish and distorted. In addition, whiteflies excrete a sugary substance known as honeydew, which serves as food for a fungus called “sooty mold.” Sooty mold creates a black film over leaves and prevents plants from photosynthesizing. If a gardener finds a plant after it has developed symptoms from the whiteflies, viral diseases, and sooty mold, it will be hard for them to figure out how to treat this plant. Encourage gardeners to frequently check their gardens to catch pest problems before they progress. Keep in mind that some insects like to hide on the underside of leaves, such as whiteflies, but others prefer to sit around the veins and new/unfurled leaves, such as aphids.

Water stress

Symptoms: leaves wilting, plant limp.

Nutrient deficiencies

Symptoms: The most common symptom of lack of nutrients is yellow leaves, but plants can also turn reddish or purplish hues if they do not have enough nutrients. Ask yourself if your plant is a different color than it should be.

Insect infestation

Symptoms: Look for “bites” taken out of leaves, skeletonized leaves, holes in stems and fruits. Also look for the insects themselves, webbing created by insects, their droppings, and chewed up plant parts.

Plant disease

Symptoms: Diseases make plants do “funny” things: wilt even if they are well watered, develop sooty black spots or a white fungus, or grow distorted leaves. Plant diseases tend to affect the whole plant, while insect pests attack individual fruit or leaves.

3. Understanding insect pests

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners will learn about three categories of insect pests frequently seen in home gardens and connect the pest category to the type of damage they do.

FACILITATOR PREPARATION: Consider asking gardeners to come to the session with a collection of leaves or other plant parts that have insect damage. Gardeners can also collect the insect pests themselves and bring them to the session.

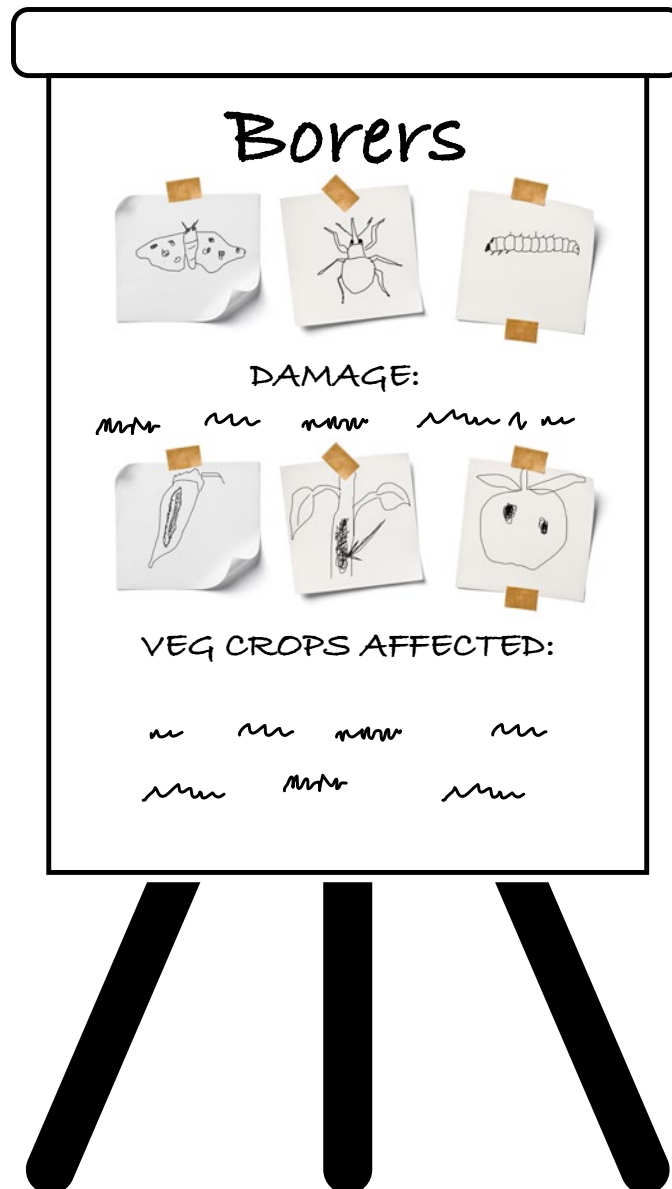
MATERIALS NEEDED:

- Flipchart
 - Paper for participants
 - Many colors of markers, especially yellows, browns, greens, for drawing insects
 - Tape
 - Insect pests collected by gardeners (optional)
 - Insect-damaged leaves and other plant parts (optional)
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1. Ask gardeners to name insect pests they have seen in their gardens. Write these names on your flipchart. Be sure to include all local names in your list and note when there are duplicate names to describe the same pest or when a local name describes a broad group of pests rather than a single kind. If gardeners have collected insect pests from their gardens, review these as a group and write down their names as well.
2. Pass around the paper and markers you have brought and assign each participant some insects to draw. Participants should draw one insect per piece of paper. Encourage them to use correct color combinations and focus on the insects’ mouthpieces to the best of their ability. If a gardener knows what the insect looks like at different life stages, they should draw these life stages together on the same paper.
3. Write ‘piercing/sucking pests’, ‘defoliators/chewing pests,’ and ‘borers’ as titles on three different flipchart papers or areas of the board. Put the flipchart papers up on the wall or on the ground if needed. Explain to gardeners that these categories describe how different kinds of insects feed on plants.

45 min

4. Pick one picture to represent each insect category and stick this picture on the appropriate paper or area of the board. Then:
 - a. Ask participants to describe the damage caused by this insect. Write down the descriptive words they use and draw pictures of the damage it creates.
 - b. If gardeners have brought samples of leaves or other plant parts with insect damage, tape these in the appropriate space.
 - c. List the vegetable crops that are most commonly affected by this pest.
5. Ask gardeners to continue placing the pictures of the insects they drew in the appropriate category, adding descriptive words and drawings as needed. If there is disagreement among gardeners about what insects cause what damage, ask them to make a mental note of the disagreement and bring it up later in the garden monitoring session.
6. When the pictures are all categorized, ask one volunteer per category to summarize the results for the rest of the participants.



KEY MESSAGES

Piercing and sucking insects/sap feeders



Sucking insects have a mouthpiece that can pierce and suck leaves and other plant tissues. These insects do not take a “bite” of the fruit or leaves, but instead suck juices from plant tissues or, in some cases, inject a toxin. This will deform the leaves and make them brown or yellow. If there are many insects, then the whole plant can wilt or die. Sucking insects can be common during early growth stages when plant tissues are full of sap. Sucking insects are important to control because they can transmit viruses that cannot be treated. These viruses cause distorted leaves and fruit and uneven ripening.

CONTROL MEASURES: Hand remove insects with a tissue or blast insects off plants with a hose, remove broadleaf weeds and waste piles that harbor sucking insects, remove highly infected plants early and bury in a deep pit or burn.

COMMON EXAMPLES: Aphids, leafhoppers, whiteflies, thrips, scale insects, mealybugs, true bugs, spider mites (not technically an insect, but still an important crop pest).

Defoliators/chewing insects



Defoliators are leaf eaters and make visible “bites” in the leaves or consume entire leaves off a stem. Leaf eaters can consume leaves at different rates, with some, like the tobacco hornworm, capable of consuming enough leaves in a day that it will profoundly harm the plant.

CONTROL MEASURES: Remove defoliators by hand. Look at every angle of the plant to find defoliators that are hiding. Some defoliators will hide in the soil during the day and feed at night. Look in the soil around the base of the plant to find any insects hiding there.

COMMON EXAMPLES: Caterpillars (army worms), cutworms, grasshoppers, maggots, spotted beetles, flea beetles, hornworms, leafminers, and other beetles.

Borers



Borers drill and tunnel into fruit, bean pods and shoots of plants as they eat. They mostly attack during the flowering, fruiting and ripening stages and leave their eggs and larvae inside the hole they have created. Look for evidence of small holes in fruits or pods. Shoots will look weak and droop due to internal damage from these feeding pests. Fruits, pods and shoots can be discolored or grow abnormally, e.g. be small and irregularly shaped.

CONTROL MEASURES: It is very important to control borers early in their life cycle. Larvae of borers may be found briefly on the outside of plants and can be removed by hand before they begin boring. Remove infected fruit, stems, pods from the garden and bury or burn them in a place away from the garden.

COMMON EXAMPLES: Weevils, cutworms, pod borers, fruit and shoot borers, stem/bean flies, moths.

4. Beneficial insects and plants that attract them

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners learn to identify the insects that are beneficial to their garden, how they are beneficial, and which plants attract them.

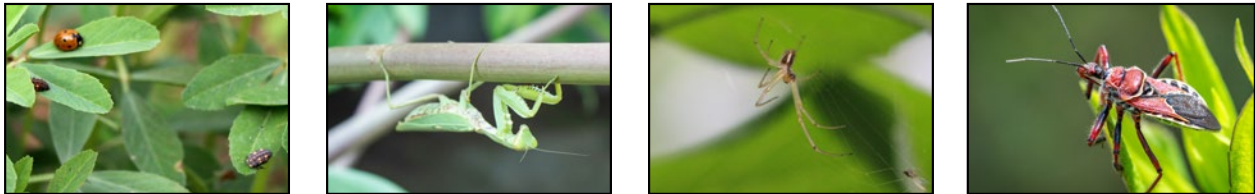
MATERIALS NEEDED: Flipchart and markers

1. Ask gardeners if there any insects that can be beneficial to our gardens. How do these insects help us?
2. Divide your flipchart or board into two columns. Write "Pollinators" in one column and "Natural Enemies" in the other column. Ask gardeners for examples of each. Prompt them if needed.
3. Split gardeners up into small groups and ask them to discuss which plants can be planted in a garden to attract beneficial insects and where in their gardens they would put these plants. Why is it important that these plants be flowering for them to have a "pest control" effect?
4. Bring gardeners back together and ask each group to share their ideas with the larger group.

KEY MESSAGES

Not all insects do damage to our plants. Lots of insects are actually beneficial!

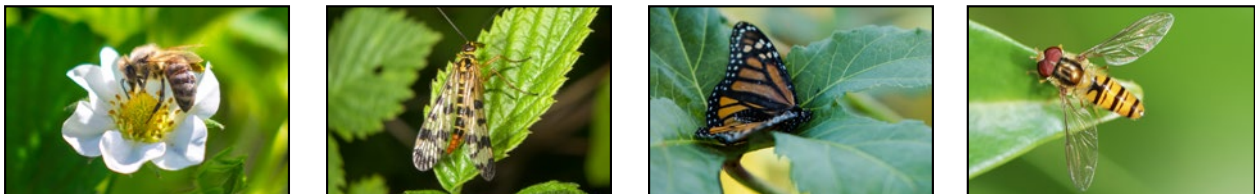
Natural enemies



Some insects eat other insects or lay their eggs inside of them (killing them when the young hatch and start to feed) and can therefore help control their populations.

EXAMPLES OF NATURAL ENEMIES: ladybugs, praying mantises, centipedes, small wasps, spiders, lacewings, hoverflies, dragon flies, assassin bugs, earthworms, and pirate bugs.

Pollinators



Other insects help spread pollen from flower to flower as they fly. You will often see pollinators "busy" around flowers as they collect food for themselves - they are simultaneously helping your flowers develop into fruits.

EXAMPLES OF POLLINATORS: bees, bumble bees, flies, hover flies, butterflies, and moths

Attracting beneficial insects with flowering plants



One way to attract the beneficial insects to our garden is to plant flowering plants around the margins of our gardens. Not only does this look good, the insects also come to feed on these flowers and stay to feed on the insect pests in your garden.

Some good flowering plants include:

- Herbs like parsley, dill, lavender, lemon balm, coriander, basil, celery, fennel, chives, mint
- Flowers like marigolds, sunflowers, corn flowers, calendula.
- Stinging nettles and wild mustards
- Brassicas (kale, cauliflower, broccoli) that you are leaving to develop seed

5. Insect pest life cycles

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners will learn about insect life cycles and how this information can help them better identify insect pests and beneficial insects.

FACILITATOR PREPARATION: Facilitator should familiarize themselves with common and/or most destructive local insects and their life cycles if these life cycles are missing from the material provided in this module.

MATERIALS NEEDED:

- Flipchart
 - Paper for participants
 - Many colors of markers, especially yellows, browns, greens, for drawing insects
 - Tape
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1. Use the **Insect Life Cycles Training Aid** to review the different life stages of insects.
2. Split participants up into 'piercing and sucking,' 'defoliators/chewing,' 'borers,' and 'beneficials' small groups. Have each group pick one insect from their category and draw a picture of its life cycle. Rotate the groups so every group draws a picture from each category. Provide some guidance into what are the common life cycle phases for each insect category to help guide gardeners.

KEY MESSAGES

Understanding an insect's life cycle can help gardeners search for and eliminate insect pests before they become a problem. Eggs can be removed before they turn into leaf-eating larvae and winged insects can be prevented from laying eggs on crops with a net. Additionally, gardeners may be able to more easily identify their main pest problem if they see the same insect at various life stages on their crops rather than mistakenly thinking they have two or three different pests damaging their crops.

6. Understanding and managing plant diseases

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners will learn what plant diseases are and how to manage them in a home garden.

MATERIALS NEEDED: Flipchart and markers

1. Ask gardeners how plant diseases can affect their gardens.
2. Give participants five minutes to quickly discuss with their neighbors *the symptoms plants have when they are sick*. After five minutes, ask participants to share and write their ideas on your flipchart or board. Encourage them to be as specific as possible. If gardeners mention symptoms that could be due to other reasons, such as water stress, nutrient deficiencies or insects, note this by reviewing the list from the earlier discussion on 'What is wrong with my plants.'
3. Give gardeners another five minutes to quickly discuss with their neighbors *how diseases in humans spread* (for example, bacteria in water or food or viruses by sneezing, coughing and physical contact). After five minutes, ask participants to share with the larger group and write their ideas on your flipchart or board.
4. Now ask gardeners to discuss with their neighbors *how plant diseases spread*. After five minutes, have the participants share their thoughts with the larger group. Elicit the main ways plant diseases spread (insects, soil, seeds, water, wind, and physical contact with other infected plants).
5. Draw three columns on a flipchart and write the main ways plant diseases can spread in the column to the left. On top of the middle column write "What NOT to do" (or just an **X**) and on top of the right column write "What TO DO" (or just a tick **✓**).
6. Work through each category, asking gardeners what NOT to do and what TO DO to manage diseases.
7. Finish the session by asking gardeners to develop one sentence with their neighbors that summarizes how to keep a garden free of disease (for example, "Keep your soil, plants and seeds healthy and your water clean"). Give participants two minutes to come up with their summary sentence.

KEY MESSAGES

- Plants can get sick just like people! A plant infection can be very mild—and the plant will still yield produce that can be eaten—or an infection can kill the plant. Plant diseases cannot harm humans, but they can dramatically lower yields and make produce unsuitable for eating.
- Plant diseases express themselves differently depending on the crop and how badly the plant is infected. This makes it difficult for gardeners to know for certain what disease is affecting their crops. Nonetheless, gardeners should always work to stop the disease from spreading within their gardens and their neighbors' gardens. It is very hard to manage plant diseases once they are present, so the best strategy is to prevent them from occurring or from getting out of control.
- Some disease symptoms can be similar to the symptoms plants have when they lack water or nutrients. Taking good care of the plants will therefore make it easier to diagnose a diseased plant since you know it is not underfed or under watered. If the garden on a whole is healthy, but an individual plant or part of a plant is showing signs of being sick, this is an indication that the plant is suffering from a disease and should be removed from the garden.

What symptoms do plants have when they are sick?

Some common signs and symptoms of plant diseases include:

- White, brown, or black fungal growth
- Angular brown leaf spots where plant tissue may have died with a yellow “halo” around it
- Leaf spots that have a “bull’s eye” appearance
- Concentric yellow ring spots
- Reddish or orange fuzzy “rust” on leaves
- Yellowing leaves
- Galls on plant roots
- Entire plant or branches wilting
- Water-soaked lesions on plants
- Fruits that have soft, rotting spots and potentially mold
- Fruits that are abnormally colored
- Mosaic leaf patterns or irregular patchworks of green and yellow areas over the surface of a leaf
- Yellow bands along the main veins of leaves
- Crinkled or distorted leaves
- Plants remain small and stunted despite good bed preparation
- A thick, gummy substance emerging from an infected stem or canker.

Diseases can spread through...	What NOT to do?	What to do?
Insects	✗ Do not let insect pests get out of control.	✓ Monitor crops regularly for insects and practice prevention and control measures.
Soil	✗ Do not put infected plants in compost piles and then spread this compost in your fields.	<ul style="list-style-type: none"> ✓ Practice crop rotation. ✓ Pull up infected plants and burn them right away. ✓ Add disease-free organic material to your garden beds to build up soil fertility and “healthy” microorganisms.
Seeds	<ul style="list-style-type: none"> ✗ Do not harvest seeds from infected plants. ✗ Do not plant seeds that are moldy. 	<ul style="list-style-type: none"> ✓ Know the source of your seeds as much as possible. Harvest seeds from healthy and productive plants. ✓ Keep seeds dry and clean in an airtight container.
Water	✗ Avoid splashing water as much as possible if diseases are a major problem in your garden.	<ul style="list-style-type: none"> ✓ Intercrop to reduce the spread of diseases from an infected plant to its neighbors and to reduce rain or irrigation water from splashing soil on plants. ✓ Stake plants to improve air circulation between leaves and help plants get dry.
Wind		✓ Plant a windbreak to protect plants.
Infected plant tissue	✗ Do not put infected plants in the compost pile.	<ul style="list-style-type: none"> ✓ Prune away any infected plant leaves, stems, and fruits and burn them. ✓ Pull up any very infected plants completely and burn them.

7. Closing discussion

Ask participants to share with the group:

- Something they learned in the session
- How they could support each other in helping identify pests and diseases

Managing Pests and Diseases



OVERVIEW

LEARNING OBJECTIVE

Participants will learn techniques for preventing and controlling pests and diseases.

MATERIALS NEEDED

- Flipchart and markers
- Paper and pencils to distribute to participants
- Yellow, blue or both colored cards or objects that contain these colors
- Oil, grease, or another sticky substance
- String, poles, or another material to fix the colored cards to in the garden
- Water bottles or other plastic containers to place as pit traps
- Knife to cut water bottle tops
- Water and vinegar or salt to place in pit traps

DURATION



KEY CONCEPTS

- A strong, healthy garden is more capable of resisting an attack from pests and diseases than an unhealthy garden. Our goal is to shift our energy away from fighting pests and diseases to actions that will prevent them from happening in the first place.

TRAINING AGENDA

1	Introduction and warm-up	 DISCUSSION	10 min
2	Preventing insect pests and diseases	 DISCUSSION	40 min
3	Rotating crops to prevent disease	 DISCUSSION	30 min
4	Managing pests and diseases	 DISCUSSION	40 min
5	Monitoring our gardens for pests and diseases	 PRACTICAL ACTIVITY	30 min
6	Closing discussion	 DISCUSSION	10 min

1. Introduction and warm-up

Welcome gardeners to the training. Do a brief introduction to today's topic and review the training agenda. You may want to outline the training agenda on your flipchart or board so gardeners can see it when they arrive.

Conduct a warm-up exercise or ice-breaker to make sure all gardeners feel welcome and are ready to fully participate. Suggested warm-up and ice-breaker activities can be found in the Facilitator's Guide: Encouraging Learning through Participant Engagement.

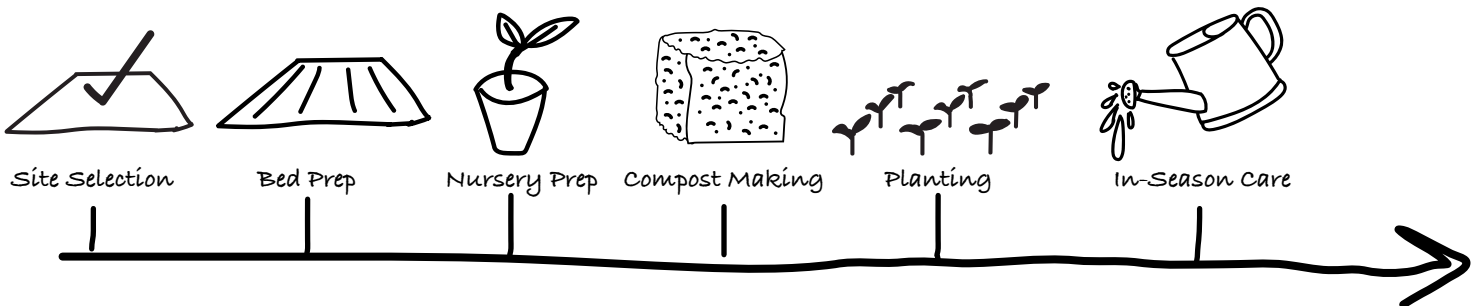
2. Preventing insect pests and diseases

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners see how pest and disease management can start even before pests and diseases are present.

MATERIALS NEEDED: Flipchart and markers

1. Ask gardeners when is the best time in the season to start pest and disease management. Have gardeners give their answers and explanations.
2. Explain to gardeners that we can start to manage pests and diseases even before we plant our first seed.
3. Draw a horizontal line on your flipchart to represent a timeline of the season. Have gardeners list the steps they take from preparing to plant a crop up until pests and diseases appear in their gardens. Include steps that take place outside of the garden too, like building a nursery or compost pile. Use pictures and words to depict these steps on the timeline.
4. Starting at the beginning of the timeline, ask gardeners to list all the actions they can take to prevent pests and diseases from entering and spreading in their gardens. Write these preventative actions below each gardening step and add others that gardeners may have missed.
5. Emphasize to gardeners that all the actions they have listed are considered pest and disease control, even though they have done them before they saw a single pest.



KEY MESSAGES

Pest and disease management does not start when we see the symptoms! It starts even before we plant our first seed. Gardeners can reduce the amount of insect pests and diseases in their gardens by carefully preparing their garden space, practicing crop rotation, and cleaning their equipment and tools prior to use.

Gardening steps	Preventative Action
Site selection	<ul style="list-style-type: none"> • Pick a site where crops have done well in the past. If you see, for example, that tomatoes continuously seem to have a disease in certain sites, do not plant tomatoes there, but plant a different crop in its place (crop rotation).
Bed preparation	<ul style="list-style-type: none"> • Enrich garden bed soil with disease-free compost or rotted manure to build healthy soil capable of fighting diseases. • Be aware that mulch can also provide habitat for slugs and other pests. Reduce level of mulch if necessary. • Trim away overhanging branches so that sunlight can dry moisture in the garden during the day. • Plant flowering plants around garden perimeter to attract beneficial insects to the garden. Parsley, sunflowers, marigolds, and holy basil are plants that attract beneficial insects. • Clean tools and boots before preparing beds. Diseases can spread from an infected bed to an uninfected one through soil on tools and boots.
Nursery preparation	<ul style="list-style-type: none"> • Plan for a diversity of vegetables in your garden. • Use clean equipment, containers, and hands for planting. • Check seeds for mold before planting. Do not plant moldy seeds. • Place seeds in a hot water bath for 20 minutes. Place seeds in a water-permeable cloth and tie securely. Boil water and then let cool for 10 minutes. Pour water in a bowl and submerge seeds for 20 minutes. Place seeds in a bowl of not-hot water afterwards to stop treatment. Dry seeds before planting so they can be evenly spread in the soil. • Observe if seedlings are experiencing "damping off." Symptoms can include: seedlings fail to emerge; first leaves are water soaked, mushy or discolored; stems are water soaked and very thin; young leaves wilt and turn brown; roots are absent or stunted; or fluffy white growth appears. "Damping off" diseases spread in cool, wet conditions. In the future, allow more sun to reach seedlings, improve water drainage, and use clean soil, tools, and containers. • Plant disease-resistant varieties of vegetables if available.
Compost preparation	<ul style="list-style-type: none"> • Use only disease- and insect-free material in compost piles. • Clean tools regularly.
Direct seeding and transplanting	<ul style="list-style-type: none"> • Check seeds for mold before planting. Do not plant moldy seeds. • Place seeds in a hot water bath for 20 minutes. Place seeds in a water-permeable cloth and tie securely. Boil water and then let cool for 10 minutes. Pour water in a bowl and submerge seeds for 20 minutes. Place seeds in a bowl of not-hot water afterwards to stop treatment. Dry seeds before planting so they can be evenly spread in the soil. • Practice crop rotation. • Use netting to protect young seedlings. • Plant disease-resistant varieties of vegetables if available. • Intercrop beds or plant a diversity of species within the garden to "confuse" pests and reduce the amount of food available for each species of insect pest. Insects are often specialists; if gardeners plant a diversity of crops, then that species has less to eat and has to look harder to find it.
In season care	<ul style="list-style-type: none"> • Monitor crops daily for pests and diseases. • Use colored sticky traps (yellow, blue) for pest monitoring. • Manage weeds that may harbor pests. • Use a "pest prevention spray" on crops (see below). • Use netting to protect plants from insect pests. • Sprinkle wood ash around garden. • Stake or trellis plants to improve air flow between leaves. • Prevent waterlogging of soil, which creates damp conditions favored by many pests and diseases.

A strong, healthy garden is more capable of resisting an attack from pests and diseases than an unhealthy garden. Our goal is to gradually shift our energy away from fighting pests and diseases to actions that will prevent them from happening in the first place.

What is a pest prevention spray?

A pest prevention spray is a spray that coats a crop's leaves and stems with a substance that is unattractive to insects that come to feed on it, such as aphids, mealybugs, or white flies. Garlic bulbs, onion leaves and onion bulbs, chilies, neem leaves, and many herbs (mint, basil, rosemary, dill, cilantro) have substances in them that make them unattractive to certain pests. These ingredients can be crushed or finely chopped and then soaked in water overnight. One or more ingredients can be used together in the same spray. Small amounts of soap can be added to help the liquid spray cling to the plant. Only add enough soap to cause small bubbles to form when the liquid is shaken or vigorously stirred; too much soap will "burn" the crops. Test the spray on one plant first before applying it on a broader scale. The liquid is sprayed on crops using a sprayer or dabbed on plants using a small branch with dried leaves. Special attention should be paid to the underside of leaves where pests like to hide. The spray should be applied late in the day to avoid burning leaves in the hot sun and can be applied a few times a week if needed.



Ingredients for making pest prevention spray

How can we use wood ash to repel pests?

Sprinkle wood ash from a fire around the base of plants to repel surface-feeding insects such as slugs and snails. Wood ash dehydrates soft-bodied insects. When dusted on crops, it will deter chewing insects that do not like the gritty texture. However, wood ash loses its deterring properties when it gets wet and must be reapplied. It therefore needs to be applied regularly. Wood ash should be used selectively since continuous use may increase the soil pH or accumulate salts to levels harmful to plants.

How does a colored sticky trap help gardeners monitor their insect pests?

Whiteflies, leafminers, fungus gnats, and aphids are attracted to the color yellow. Thrips are attracted to both yellow and bright blue color. Since these insects can be very small and hard for gardeners to see, colored sticky traps can be used to "trap" them so that gardeners can monitor their presence.

Purchase yellow or blue colored cards, or look around your environment to find objects that have large blocks of these colors in them. You can also use yellow or blue paint to coat metal, plastic, or another reusable item in this color. Make the traps sticky by applying oil or grease over the yellow or blue color. Fasten the traps to posts or use string to hang the traps within the garden. The traps should be placed on or between the crops at crop level where pests can be a problem - if the traps are too far away from the pests' food source (your crop!) or too high above crops, then pests may not encounter the traps. Try laying traps both vertically and horizontally to see which direction is best at capturing pests and adjust your traps as needed. The traps themselves may not control the pests, but will help to reveal what insect pests are present and to what extent. Traps that fill up quickly indicate a serious pest problem that should be controlled through another management strategy as soon as possible.



Homemade yellow cup sticky trap



Hanging sticky trap

3. Rotating crops to prevent disease

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners learn the benefits of crop rotation for pest and disease control, as well as other aspects of a healthy garden.

MATERIALS NEEDED: Paper and pencils to distribute to participants

1. Distribute pieces of paper torn into palm-sized squares to the gardeners. Working in small groups, ask them to quickly draw locally available vegetables that they like to eat and put the names of the vegetables below the picture. Give gardeners a few minutes to complete their drawings.
2. Draw four columns on your board or flipchart and write "Seeds/Seed Pods - Leaves - Fruits - Roots" in that order at the top of the columns. Ask each group to come to the flipchart or board and tape their drawings in the column that best describes the part of the plant that is best to eat.
3. Draw a square on your flipchart or board to represent a garden bed. Move one drawing from the Seeds/Seed Pods column to the square and explain to gardeners that they can pick one crop from this group to plant in the garden bed first. Move this drawing back to the Seeds/Seed Pods column and select one from the Leaves column, followed by a drawing from the Fruits and then the Roots column. Explain that a new season is starting each time you move a drawing to the square. Show the **Crop Rotation Training Aid** to gardeners to help explain this idea.
4. Explain to gardeners that switching what type of crop is planted in a garden bed season after season helps control pests and diseases by removing their food source for multiple seasons. Have gardeners share additional thoughts on how practicing crop rotation can reduce pests and diseases.
5. Explain that rotating crops also benefits the soil as each crop uses different combinations of nutrients pulled from different parts of the soil. Draw examples of typical root structures for each crop type at the bottom of each column and discuss how following the sequence of Seeds/Seed Pods → Leaves → Fruits → Roots can help build healthy soils.
6. Emphasize that rotating crops seasonally helps build a healthy garden, but is also important for their and their families' health. Eating a diversity of vegetables helps your body get all the nutrients it needs to stay strong.

KEY MESSAGES

Crop rotation is the practice of moving crops from one bed to another, or from one place in a bed to another place in the same bed, from season to season.

Why do we rotate crops?

Lower pest and disease impact: Insects and diseases specialize in attacking vegetables that are within the same plant family. To keep insects and diseases from making a big impact on your garden, alternate between plant families to make it more difficult for insects and diseases to spread throughout the garden. When you remove crops from a particular plant family from the garden, the insect pests that live and feed on it will no longer be able to reproduce in the garden.

Healthy soils: By having a diversity of crops in your garden, you will be encouraging plants to use different nutrients from different parts of the soil. Some plants can also help the health of soil. Legumes, for example, add nitrogen to the soil that can later on be used by plants that require a lot of nitrogen, such as brassicas.

Better yields: With better soil health and fewer pests, you will have more vegetables. Having a diversity of crops within your garden will also limit the yield losses you have from any one pest or disease.

By rotating from Seeds/Seed Pods → Leaves → Fruits → Roots, we will rotate what plant families we are planting in the same garden bed season after season.

Plants grown for their **seeds or seed pods** include beans, groundnuts, and peas.

- Seed crops help rebuild soil fertility by adding back nutrients.
- Even though some vegetables, like cowpeas, are grown for their edible leaves, they should be classified as a 'seed' vegetable for crop rotation purposes.

Plants grown for **leaves** include amaranth, lettuce, and cabbage.

- Leaf plants require a lot of soil nutrients, so can be planted in a freshly prepared, well-fertilized garden bed or directly after a seed plant.

Plants grown for their **fruits** include cucumber, eggplant, gourd, Irish potato, melon, pepper, pumpkin, squash, and tomato.

- Fruit crops can manage more nutrient stress than leaf plants, but still require well-fertilized soil. Many fruit crops are also highly susceptible to soil-borne diseases, such as blights and wilts, so it is especially important to follow fruit crops with crops from different categories in a garden bed to break the cycle of disease. Some diseases can be very persistent in soil, even lasting twenty or thirty years in the soil, but planting other crops in between fruit crops can reduce the level of disease in the soil and allow fruit crops to survive.
- Even though some fruit vegetables, like pumpkins, are grown for their edible leaves, they should be classified as a 'fruit' vegetable for crop rotation purposes.

Plants grown for their **roots** include beets, carrots, garlic, onions, radishes, sweet potatoes, turnips, and radishes.

- Root crops can help break the cycle of disease while accessing nutrients from different places in the soil profile than leaf or fruit vegetables.

40 min

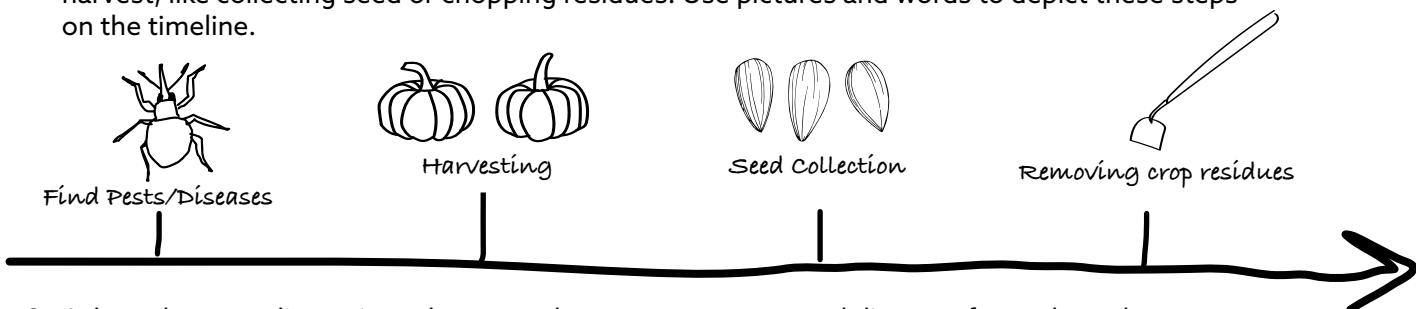
4. Managing pests and diseases

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners will learn how to manage pests and disease outbreaks.

MATERIALS NEEDED: Flipchart and markers

1. Draw another horizontal line on your flipchart to represent a timeline of the season. Now have gardeners list the steps they take from observing pests and diseases in their garden up until the end of the season. Include steps that take place outside of the garden and steps that occur after harvest, like collecting seed or chopping residues. Use pictures and words to depict these steps on the timeline.



2. Ask gardeners to list actions they can take to manage pests and diseases for each garden step. Write these management actions below each gardening step and add others that gardeners may have missed.
3. Emphasize to gardeners that managing pests and diseases appropriately now is also helping reduce the severity of future outbreaks.

KEY MESSAGES

Timely pest and disease management can prevent outbreaks that are more serious if diseases are controlled and insect pests cannot reproduce. Timely management can also help reduce the severity of future attacks.

Gardening step	Management actions
In season care	<ul style="list-style-type: none"> • Monitor crops daily for pests and diseases. • Hand remove small infestations of insects. • Use colored sticky traps (yellow, blue) for pest monitoring. • Manage weeds that may harbor pests. • Use a “pest prevention spray” on crops. • Use netting to protect plants from insect pests. • Sprinkle wood ash around garden. • Stake or trellis plants to improve air flow between leaves. • Allow chickens to search for insects in nearby shrubs or woody areas to eat insects before they enter the garden. If insects that are favored by chickens are observed in the garden, allow chickens to enter to consume these insects. Observe carefully to make sure chickens are not damaging plants in the process and wash any produce thoroughly before consuming to remove chicken poop. • Prune away disease-infected leaves, branches, or entire plants and bury them in a deep pit away from the garden or burn them if possible. • Reduce mulch levels if insects are hiding there. • Avoid overwatering and creating a moist environment where diseases can grow. • Prevent waterlogging of soil, which creates damp conditions favored by many pests and diseases. • Avoid overhead watering that allows water to splash from plant to plant and potentially spread disease. Water plants at the base instead.
Harvesting	<ul style="list-style-type: none"> • Remove inedible, old fruits that might be harboring insects. If fruits are found to contain insects, bury them in a deep pit away from the garden or burn them rather than compost them.
Seed collection	<ul style="list-style-type: none"> • Only collect seeds from healthy, disease-free plants. • Make sure seeds are mature and properly dried before harvesting.
Removing crop residue	<ul style="list-style-type: none"> • Bury every insect and disease-infested residue in a deep pit away from the garden or burn it rather than compost it.

How can we use pit traps in our garden?

Pit traps are used to catch crawling insects, such as slugs and snails, as they approach crops. Cut the top off a water bottle or other plastic container. Bury it in the garden so that the top of the plastic is level with the soil. Fill the container with a few centimeters of water and add something toxic to the pests, such as vinegar or salt. The water should be deep enough that the insects cannot crawl out again. Place as many pit traps as desired around crops.



Photo Credit: EatTheSeason.com

5. Monitoring for pests and diseases

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Gardeners will spend time looking for evidence of insects and diseases in a garden and discuss what actions they would take to manage those pests. Gardeners will also place colored sticky traps and pit traps for pest monitoring.

FACILITATOR PREPARATION: Identify a garden, or gardens, in advance where participants can observe symptoms of pest and disease damage.

MATERIALS NEEDED:

- Yellow, blue or both colored cards or objects that contain these colors
 - Oil, grease, or another sticky substance
 - String, poles, or another material to fix the colored cards to in the garden
 - Water bottles or other plastic containers to place as pit traps
 - Knife to cut water bottle tops
 - Water and vinegar or salt to place in pit traps
-

STEP 1. Bring gardeners to a garden where they can look for evidence of pests and diseases.

STEP 2. Explain to gardeners the importance of monitoring for pests and diseases early and often. Also explain the importance of visiting the garden at different times of day and night to catch pests when they are active.

STEP 3. Let gardeners find plants expressing symptoms of pest and disease damage, as well as the pests themselves.

STEP 4. Discuss the symptoms found by gardeners, what could be the cause of these symptoms, and what could be done to control any pest and disease outbreaks found in the garden. Ask gardeners what steps could be taken next season to prevent these pests and diseases from entering the garden again.

STEP 5. Build sticky traps and pit traps with gardeners and place them in the garden.

KEY MESSAGES

Why should we monitor our gardens for insect pests?

By regularly checking our gardens for insect pests, we can quickly identify if there are any problem insects and stop them before they spread to other plants or crops. It is much easier to control a small pest outbreak than it is to try and save a crop from failing because of a severe outbreak.

How do we monitor our gardens?

Insects are generally good at hiding. This means we have to be very thorough and creative when we look for them.

- Get down on your hands and knees when observing the crop and soil
- Examine the undersides of leaves, nodes of plants, and inside flowers
- Dig in the soil or mulch looking for insects
- Leave a plastic bag in the soil near plants overnight and check it in the morning to see if any insects are hiding under it.
- Place pit traps on the ground to catch slugs and snails
- Take a plant and shake it while catching the insects that fall with a white piece of paper
- Use colored sticky traps to observe small flying insects like whiteflies or thrips
- If you need to pull up any individual plant, shake it in a bucket to observe the insects that were on it.
- Come to the garden at different times of day and night to observe if insects are feeding.

When monitoring pests, it is important to take note of the type of insects you find, the number of plants affected, the severity of damage to individual crop plants, and area of crop affected by the pest. It is also important to keep monitoring your garden even when you are treating the pest problem to see if what you are doing is successful.

6. Closing discussion

Ask participants to share with the group:

- Something they learned in the session
- How they could support each other in helping identify pests and diseases

10 min