Basic Vegetable Gardening
Lesson 9: Natural Pesticides
Part A – Recognizing plant diseases

Lesson Summary: Members will look in the garden for signs of pests and insects. They will learn how to make natural pesticides. If necessary, they will apply the fungicide or insecticide to the garden.

Learning Outcomes:

Members recognize signs of pest and insect damage.
Members make and properly apply natural pesticides.

Length: This lesson can be given in 2 parts

A. Identifying plant diseases – 60 minutes
B. Making natural pesticides – 30 minutes

Materials:

One piece of paper and a pencil for every 3 members
Chalkboard or large paper for the leader
If possible, gather a few insect or disease-damaged leaves from the garden to show the members.
Posters or illustrations from the training materials:
- Plant Diseases
- Disease Triangle

Background: This lesson is part of tending the garden after it is planted but can be given at any time after plants have germinated.

Lesson Steps

1. **(5 minutes) – Introduction**
   Review the items completed at the previous meeting. (If your group completed Lesson 8, review the information learned about watering the garden. If you have a water collection or measuring system, discuss the amount of rain the garden is getting and if it is enough for the plants. Discuss if you need to water the garden more or less.)

   Also, check on the mulch that was put on the garden during the last meeting. Discuss any issues that have come up, and make plans to put more mulch on the garden if necessary.

2. **(20 minutes) – Brainstorm to investigate major questions about pests and insects.**

   Question to investigate: What pests and insects are beneficial (helpful) to your garden?

2.1 (10 minutes) Have members list several ways that insects can benefit the garden. Have them work in groups of three. Encourage them to think broadly about different types of organisms that might benefit the garden. Write their ideas on a piece of paper.

Expected results/Answers:

- Bees are essential for pollinating many plants.
- Microbes such as beneficial bacteria and soil fungi are important for improving soil structure.
- Bacteria change nitrogen found in the air into a type of nitrogen that plants can use.
- Bacteria also break down elements in the soil, decompose organic matter and break down unhealthy chemicals.

Sometimes people think of insects and microbes as unwanted organisms, but some types are extremely necessary for plant growth. Include this information if the members are not aware of the benefits of some microbes.

Some organisms can harm crops. We call these *pests.* A pest can be a plant, an insect, a fungus, or an animal. When most people think of pests they think of insects, but fungi, viruses, bacteria, weeds, rodents and other organisms can be as destructive as insects. They may all compete with us for food, cause injury, or just be annoying. Fortunately, we can control pests to some extent or limit their impact without damaging our environment.

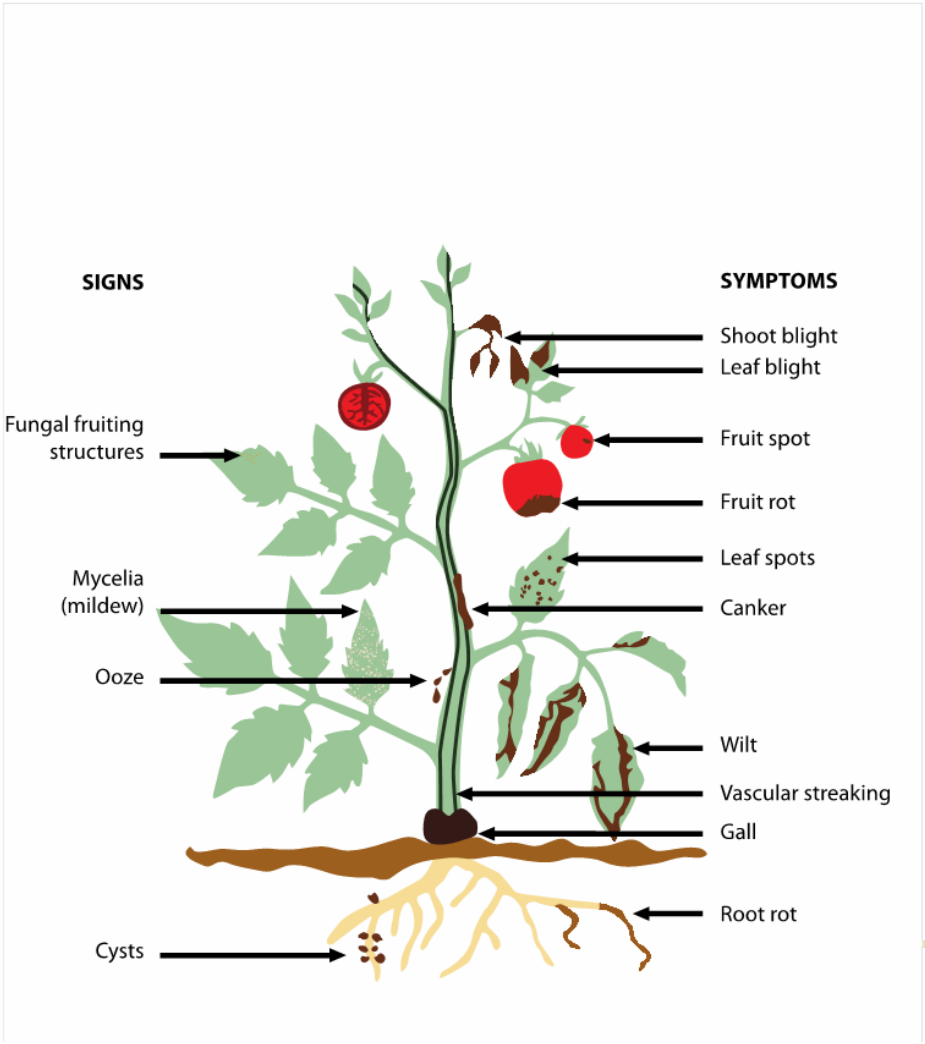
Question to investigate: What signs are present when pests and insects are harming your garden?

2.2 (10 minutes) Ask members to draw a plant or plants that have been harmed by pests or insects. (They can use the other side of their papers.) Allow several minutes to complete drawings together.

Expected results: Members should draw a plant or plants that have been physically damaged by pests or insects. There may be a wide variety of drawings.

2.3 Use the poster of the drawing below to show different types of diseases. Point out that no one plant will have all of these diseases.

Plant Diseases: Signs and Symptoms



A plant disease disturbs the physiology, structure or function of the plant. There are two causes of plant disease:

1. Biotic causes involve infectious pathogens that spread from plant to plant. The three most common are fungi, bacteria and viruses.

2. Abiotic causes are non-living, including such things as excess moisture, shortage of plant nutrients and heat extremes.

Disease symptoms are the changes in the plant produced by the disease. Usually they are discolored, deformed or dying regions on the plants. Examples are

- Necrotic or dead areas
- Rots, spots and blights
- Discoloration, yellowing or chlorosis of leaves
- Galls are overgrowth of plant tissue
- Stunting of plants or general overall poor growth
- Wilting of the whole plant.

2.4 Discuss the members' drawings. Drawings may show many of the signs listed above. Discuss any they may not be familiar with and talk about what structure of the plant they would affect.

2.5 If you collected examples of plants with diseases, have the members use the poster to identify the disease. Discuss the cause of the disease.

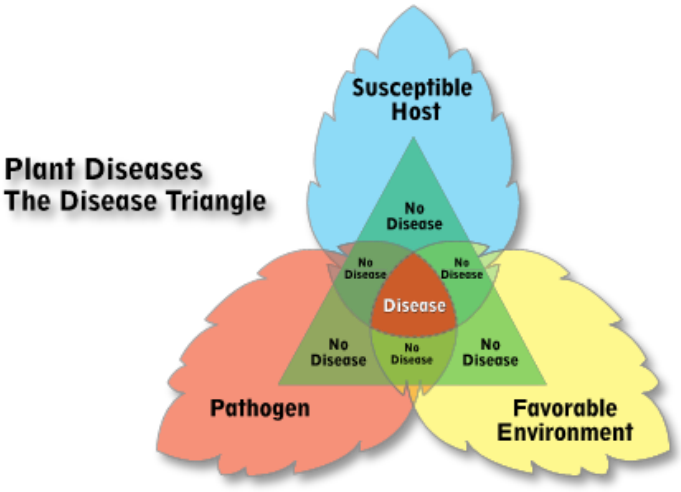
3. **(15 minutes) – Members go to the garden to look for signs of insect or pest damage.**

   3.1 (10 minutes) Have the students go out to the garden and examine the plants for signs of harmful pests or insects. All members should bring a notebook to draw a damaged plant and take notes. Go to the garden together.

   Signs of disease may come in the form of damaged leaves, damaged produce, or actual insects found on the leaves. If possible, show the members a few examples of leaves from the garden that have been damaged. The treatment is very different depending on the source of damage, so encourage them to find what kind of organism contributed to the damage.

   3.2 (5 minutes) Discussion. Gather everyone together, and have members discuss what they found. The answers will vary depending on your garden.

4. **(15 minutes) Members decide if they will apply an insecticide or a fungicide.**
   4.1 Show the Disease Triangle poster or illustration. Discuss the three things necessary for a disease to happen in a plant:



Susceptible host – This is a plant that can get a disease. Insects like certain plants. Not all insects like all plants. Without a host plant, an insect cannot cause damage.

Favorable Environment – This means the climate is right for disease. Insects and some pathogens/bacteria need certain levels of moisture or temperature in order to live on the plant to cause damage.

Pathogen – A pathogen is a disease organism. A disease is caused by a bacteria, virus or carried by an insect. Without the pathogen, there is no disease to harm the plant.

Point out that all three conditions must be present to have a plant disease.

> Only when **all three factors** are present do you have a disease – as inside the disease triangle.

4.2 Ask members: What can a farmer do to avoid diseases?

1. Susceptible Host—Plant disease-resistant varieties or vegetables.
2. Favorable Environment—Use proper watering techniques; time watering so that plant leaves dry by nightfall. Plant the plants with enough space between them so plant leaves are not too moist. As the plants grow, trim or prune them for good air flow.
3. Pathogen—Maintain clean plantings to reduce pathogen amount; remove diseased plants and harvested plant remains out of the garden; rotate by planting different crop families after one another; use organic homemade solutions.

4.3 Optional: If there is time and the members are able, they can make a disease triangle diagram. Then label the three different parts to the triangle and color it.

5. (5 minutes) - Summary and Debrief

Ask the members the following questions:

- What did we do today?
- What are some signs to look for when determining if pests and insects are harming your garden?
- When are pests and insects beneficial to the garden?
- If you plant a garden at home, do you think there would be the same pest and insect troubles? Why? Why not?

6. (1 minute) - Close

Members should keep all copies of their notes in their record book or club diary. At the next meeting they will make natural pesticides and insecticides and apply them to diseased plants.

Basic Vegetable Gardening
Lesson 9: Natural Pesticides
Part B – Making and Applying Natural Pesticides

Length: 30 minutes

Materials: 1 liter containers – 2 for the teacher
Household soap – about 2 spoonsful – You can use any kind of soap – shaved from a bar, liquid, laundry, dishwashing…
Cooking oil – 2 spoonsful
Sodium bicarbonate – 1 spoonful
Spoons - 3
Cloth or small mop made of cloth strips, twigs, or sticks

If it is possible, it would be helpful to have enough supplies for the students to practice making the insecticide and fungicide in small groups. The materials listed above are enough for one group or the teacher.

Lesson Steps:

1. **Summarize part A of this lesson. Have members answer these questions:**
   - What are some benefits of insects in gardens?
   - What three things must be present for a plant to have a disease?

2. **Introduce the value of natural pest control.** Ask members the difference between natural and artificial pest control:

   Answers:
   Natural – Can be made out of everyday household products
   Can be inexpensive
   Does not harm the environment because it does not destroy all the bacteria in the soil, or all the insects, just the ones harmful to the plant.
   Artificial – Can work quicker and kill the diseases or insects
   Sometimes more practical for a large number of plants
   Can be expensive
   Can kill beneficial insects and bacteria as well as harmful ones
   Can be dangerous to or harm animals and people.

3. **Demonstrate a natural insecticide. Ask members to help you.**

   a. Put 1 liter of room temperature water in a jerry can or bucket. (Members will be able to see the process better if you use a bucket or clear container.)

   b. Add one spoonful of soap. Mix. Remind the students that ANY kind of soap can be used. The soap will coat the insect and suffocate it.

c. If you want to make the mixture stronger, you can add one spoonful of cooking oil. Oil will help the mixture stick to the plant and also to suffocate the insects. However, oil can burn a plant. If your mixture has oil, do not put it on a plant when it is sunny. If you have oil in your mixture, you must shake or stir the mixture often because the oil will separate from the water.

d. Use a brush or cloth to apply the mixture on both the top and bottom of the leaves and fruit of a plant. It's best to always test a mixture on a plant, wait for 1 day (about 24 hours) to see if the mixture harmed the plant.

e. Reapply the mixture after it rains or after a couple of days as necessary.

4. Ask the members these questions:

For what problem would this mixture be used?
Answer: Insects that are eating our plants.

How does it work?
Answer: The mixture coats the outside of the insect. Because insects breathe through their skin (exoskeleton), the soap suffocates them and they die.

What is the purpose of the oil?
Answer: The oil helps the mixture stick to the plant more.

Is this mixture safe to use on the parts of plants that we eat?
Answer: Yes. It is safer than a commercial insecticide. It will not harm beneficial organisms, people or animals.

When is the best time to apply this insecticide?
Answer: As soon as you see insect damage on the plant.

What are some garden plants that we eat on which we may want to use this insecticide?
Answers may be: cabbage, lettuce, spinach, tomatoes

5. Demonstrate a natural fungicide.

Fungi are a common type of pest that damage plants.

a. Put 1 liter of room temperature water in a jerry can or bucket. (Members will be able to see the process better if you use a bucket or clear container.)

b. Add one spoonful of soap. Mix. Remind the students that ANY kind of soap can be used. The soap will coat the plant.

c. Add one spoonful of sodium bicarbonate. Mix. The sodium bicarbonate will change the pH of the plant surface and will keep the fungi from growing. (This is a good time to discuss pH if the members have studied this in school.)

d. If you want to make the mixture stronger, you can add one spoonful of cooking oil. Oil will help the mixture stick to the plant. However, oil can burn a plant. If your mixture has oil, do not put it on a plant when it is sunny. If you have oil in your mixture, you must shake or stir the mixture often because the oil will separate from the water.

e. Use a brush or cloth to apply the mixture on both the top and bottom of the leaves and fruit of a plant. It's best to always test a mixture on a plant, wait for 1 day (about 24 hours) to see if the mixture harmed the plant.

f. Reapply the mixture after it rains or after a couple of days as necessary.

6. **Ask the members these questions:**

   For what problem would this mixture be used for?
   Answer: Fungi that are eating our plants.

   How does it work?
   Answer: The mixture changes the acidity of the plant surface. The fungi don't like that, and die. (Refer to the Disease Triangle. By changing the pH of the plant, it no longer has a favorable condition for the fungi to grow.)

   What is the purpose of the oil?
   Answer: The oil helps the mixture stick to the plant more.

   Is this mixture safe to use on the parts of plants that we eat?
   Answer: Yes. It is safer than a commercial fungicide. It will not harm beneficial organisms, people or animals.

   When is the best time to apply this fungicide?
   Answer: As soon as you see damage on the plant.

   What are some garden plants that we eat that we may want to use this insecticide on? *Answers may be:* Tomatoes are very susceptible to fungi. Other vegetables may include cabbage or eggplant.

7. **Point out to the members the recipes you just made, some other recipes, and some ways to prevent pests in the first place.**

8. **(5 minutes) - Summary and Debrief**
   Ask the members the following questions:
   - What did we do today?

- What are some signs to look for when determining if pests and insects are harming your garden?
- When are pests and insects beneficial to the garden?
- If you plant a garden at home, do you think there would be the same pest and insect troubles?
- What are the benefits of organic/natural pesticides? What are the disadvantages?
- Are these mixtures something you could use at home? Would they work in a kitchen or sack garden? In a large field?
- Do you have access to the supplies you need to make these at home?

9. (1 minute) - Close

Encourage members to write down in their diaries the recipes and directions for the two mixtures they made today. They might also want to write down what they observe in their gardens if they use these natural insecticides or fungicides. The directions and recipes are also in the Students Guide.

Consider these Natural Repellants
A garlic solution will repel aphids, caterpillars, cutworms and flea beetles.

A hot pepper solution will repel aphids, beetles and thrips.
Put 2 spoons of chopped hot peppers, 2 small sp0ons of chopped garlic, and 1 small spoon of soap in a liter of water for 24 hours.

A neem leaf solution suffocates soft-bodied insects like aphids. It also is effective as a repellant to many insects early in their lives. Chop the leaves and seeds of the neem tree into a bucket of water to soak for a day.

Method:
Strain the mixture through a cloth.
Mix the first or second pesticide mixture in a bucket of water. (The neem leaf solution does not need to be diluted.)
Apply to portions of plants being attacked by pests.

Start with Simple, Natural Insecticides

Natural Tea
Crush the leaves and make a strong tea from marigold, cosmos, or licorice basil.

Soapy Mixture
To control soft-bodied insects like aphids, use a small spoon of soap in one liter of warm water.

After preparing, apply to portions of plants being attacked by pests.

Recipe for Natural Fungicide

Ingredients:
1 heaped spoon of grated soap (optional)
2 cups hot water (hot water helps dissolve the soap)
1 heaped spoon of sodium bicarbonate (baking soda)

Method:
1. Dissolve soap in water.
2. Add baking soda and mix well.
3. Mix one cup of fungicide mixture with 10 cups (1 small bucket) of water.
4. Apply to portions of plants before the disease progresses. Rain will wash off the fungicide, so reapply solutions when necessary.