# Week 4: Garden Detectives: Diagnosing Plants & Managing Challenges

## Objectives

* Identify and recognize common pests and diseases affecting plants in Indiana.
* Understand the physical manifestations of nutrient deficiencies in plants and their management techniques.
* Implement sustainable pest and disease control methods to maintain plant health.
* Familiarize with key observation points for plant growth patterns, health, and environmental factors.
* Establish a consistent and effective plant observation routine for early detection and intervention.
* Promote the importance of biodiversity, healthy soil, and balanced ecosystems for optimal garden outcomes.

## Handouts

* Garden Journal Week 4
* Pests
* Beneficial Insects

## Outline

### What Farming and Gardening Looks Like

***Handouts and Video***

* [How Urban Farming Saved a Dallas Community](https://www.youtube.com/watch?v=gfCcI6_1iiA&ab_channel=Freethink) (6 minutes)

### Common Garden Pests in Indiana

**Aphids**

* **Appearance:** Tiny, soft-bodied insects that can be green, yellow, brown, red, or black.
* **Damage:** They suck plant sap, leading to curled, distorted, or yellowed leaves. They also excrete a sticky substance called honeydew that can attract other pests or foster mold growth.
* **Recognition Tip:** Look for clusters of them on the undersides of leaves.

**Japanese Beetles**

* **Appearance:** Metallic blue-green beetles, about 1/2-inch long with bronze wing covers.
* **Damage:** They chew on flowers, fruits, and leaves, often leaving a skeletonized pattern.
* **Recognition Tip:** Often seen in groups during the day, especially on roses.

**Cutworms**

* **Appearance:** Gray or brown caterpillars that curl up when touched.
* **Damage:** They cut off young plants at the base.
* **Recognition Tip:** Often found just below the soil surface near damaged plants.

**Squash Bugs**

* **Appearance:** Brown, flat-backed bugs that are about 1/2-inch long.
* **Damage:** They suck plant sap, causing wilting and eventual death of plants, especially squash and pumpkins.
* **Recognition Tip:** Check for copper-colored eggs on the undersides of leaves.

**Tomato Hornworms**

* **Appearance:** Large green caterpillars with white stripes and a horn-like tail.
* **Damage:** They feed on tomato plants, often defoliating large portions or feeding on the fruit.
* **Recognition Tip:** Check tomato plants regularly; these caterpillars blend in well.

**Slugs and Snails**

* **Appearance:** Soft, slimy creatures. Slugs look like snails but without the shell.
* **Damage:** They chew large, ragged holes in leaves, flowers, and fruits.
* **Recognition Tip:** Often active at night or on cloudy days. Look for their slimy trails.

**Spider Mites**

* **Appearance:** Tiny, spider-like creatures, often red, brown, or green.
* **Damage:** They suck plant sap, causing stippling or bronzing of leaves. Heavy infestations can lead to webbing.
* **Recognition Tip:** Look for fine webbing on plants or tap a leaf over a sheet of white paper; the mites will fall off and be visible.

**Flea Beetles**

* **Appearance:** Tiny, shiny beetles that jump when disturbed.
* **Damage:** They chew small, round holes in leaves.
* **Recognition Tip:** Often found on eggplants or young leafy greens.

#### Control and Management

While chemical solutions are available, consider integrating more natural and sustainable practices first:

1. **Beneficial Insects:** Introduce predators like ladybugs and praying mantis which feed on many garden pests.
2. **Neem Oil:** A natural pesticide that works against various pests without harming beneficial insects.
3. **Diatomaceous Earth:** Effective against soft-bodied pests.
4. **Regular Inspection:** Monitor plants frequently to catch and address infestations early.
5. **Crop Rotation:** Changing where you plant specific crops each year can prevent pests from becoming established.

Remember, a well-balanced garden ecosystem can naturally keep many pests in check. Embrace biodiversity and promote healthy soil for best results.

### Common Plant Diseases and Their Effects

**Powdery Mildew**

* **Appearance:** White, powdery spots on leaves and stems.
* **Effects:** Causes stunted growth, yellowing leaves, and reduced flowering. Severe infections can lead to plant death.

**Late Blight**

* **Appearance:** Dark, water-soaked spots on leaves which eventually turn brown and papery. Can also affect fruits.
* **Effects:** This disease is especially harmful to tomatoes and potatoes. If not controlled, it can quickly spread and devastate an entire crop.

**Black Spot**

* **Appearance:** Dark, round spots with fringed or feathery edges, primarily on rose leaves.
* **Effects:** Weakens the rose plant by reducing photosynthesis. Affected leaves may yellow and drop prematurely.

**Verticillium Wilt**

* **Appearance:** Yellowing between the veins of older leaves which eventually turn brown.
* **Effects:** Impedes water transportation within the plant. Infected plants show signs of wilting and might die in severe cases.

**Rust**

* **Appearance:** Orange to reddish-brown powdery pustules on the undersides of leaves.
* **Effects:** Reduces plant vigor. Prolonged infection can lead to reduced yield and stunted growth.

**Fusarium Wilt**

* **Appearance:** Yellowing and wilting of lower leaves, often only on one side of the plant.
* **Effects:** Disrupts the plant's vascular system. In severe cases, the plant may die.

**Clubroot**

* **Appearance:** Swollen and distorted roots.
* **Effects:** Primarily affects members of the cabbage family. Infected plants may wilt during the day and show stunted growth.

**Fire Blight**

* **Appearance:** Wilting, blackening, and curling of branch tips (resembling a shepherd's crook).
* **Effects:** A bacterial disease affecting members of the rose family, including apple and pear trees. Infected parts need to be pruned out to prevent spread.

**Damping Off**

* **Appearance:** Seedlings suddenly collapse, dark rot at soil line.
* **Effects:** A fungal disease that affects seeds and young seedlings, preventing them from growing.

#### Control and Management

Disease management in plants often requires a multifaceted approach:

* **Cultural Practices:** Proper spacing, pruning, and watering practices can prevent many diseases.
* **Resistant Varieties:** Opt for disease-resistant plant varieties when available.
* **Cleanliness:** Sanitize tools and avoid working in the garden during wet conditions.
* **Crop Rotation:** Helps in preventing diseases that reside in the soil.
* **Natural Fungicides:** Neem oil, copper, and sulfur-based fungicides can help manage many fungal diseases.

Always ensure a proper diagnosis before applying any treatment, and keep in mind that maintaining plant health is the best preventive measure against diseases.

***Handouts and Video***

* *Pests*
* *Beneficial Insects*
* https://youtu.be/XjDkfwm6rGE?si=\_VovrNnSacKFWxiM

### Plant Nutrient Deficiencies and Their Management

Plants require various essential nutrients to thrive. A deficiency in any of these can lead to specific symptoms. Here are some of the most common nutrient deficiencies and how to address them:

**Nitrogen (N) Deficiency**

* **Symptoms:** Older leaves turn a pale green or yellow because they are the first to give up their stored nitrogen for new leaves. Stunted growth might also occur.
* **Management:** Add a balanced fertilizer or incorporate compost or manure into the soil. Organic sources of nitrogen include blood meal and fish emulsion.

**Phosphorus (P) Deficiency**

* **Symptoms:** Older leaves may turn a darker green or develop a purple hue. Roots may also be stunted or appear spindly.
* **Management:** Incorporate bone meal or rock phosphate into the soil. Ensure the soil pH is between 6.0 and 7.5 for optimal phosphorus availability.

**Potassium (K) Deficiency**

* **Symptoms:** Older leaves may turn yellow or brown along the edges and might also exhibit black spots on the underside.
* **Management:** Use a potassium-rich fertilizer or add wood ash (in moderation) to the soil. Ensure adequate watering as dry soil can exacerbate potassium deficiencies.

**Calcium (Ca) Deficiency**

* **Symptoms:** New leaves may appear distorted or they may die back at the tips. Blossom end rot in tomatoes and capsicums is a common symptom.
* **Management:** Add gypsum or lime to the soil, but be cautious as lime can raise soil pH. Ensure consistent watering as fluctuations in moisture can affect calcium uptake.

**Magnesium (Mg) Deficiency**

* **Symptoms:** Older leaves turn yellow between the veins, which remain green. Red or purple hues might also appear.
* **Management:** Apply Epsom salts (magnesium sulfate) around the base of the plant and water in. This provides a quick remedy.

**Iron (Fe) Deficiency**

* **Symptoms:** Younger leaves turn yellow between the veins, while the veins remain green.
* **Management:** Lower the soil pH if it's too alkaline. Applying chelated iron or iron sulfate can provide a quick solution.

**Sulfur (S) Deficiency**

* **Symptoms:** New leaves turn pale green, and growth is stunted.
* **Management:** Incorporate sulfur-containing fertilizers, such as ammonium sulfate, or use Epsom salts.

#### Micronutrient Deficiencies

* **Symptoms:** Various symptoms including yellowing of leaves, stunted growth, or leaf distortion.
* **Management:** Use a complete micronutrient fertilizer or consider using foliar sprays for faster results.

#### Addressing Nutrient Problems

* **Soil Testing:** The best way to diagnose and treat nutrient deficiencies is through a soil test. This provides specific recommendations based on the nutrient status of your soil.
* **Balanced Fertilization:** Instead of addressing a single nutrient, often it's better to provide a balanced feed which contains a mix of essential nutrients.
* **Organic Matter:** Regularly adding compost and other organic matter to soil can help improve its nutrient content and structure over time.

Regular observation of plants and understanding their needs are crucial in preventing and addressing nutrient problems before they become severe.

### A Guide to Ensuring Healthy Growth

Actively observing your plants is a crucial practice in gardening. It helps you identify potential problems early, allowing for timely interventions. Through careful observation, you can ensure that your plants grow healthily and yield the desired results.

#### Key Aspects to Observe

**Growth Patterns**

* *What to look for:* Monitor the rate of growth. Is the plant growing too slowly or too quickly? Compare its growth to other similar plants or to expected growth rates for its species.

**Leaf Health**

* *What to look for:* Check for any discoloration, spots, holes, or wilting. Healthy leaves should be vibrant and free from any signs of distress.

**Stem and Branch Structure**

* *What to look for:* Look for strong, upright stems and branches. Weak or leggy growth, or stems that are unusually thick or thin, can be signs of issues.

**Root Health**

* *What to look for:* When repotting or planting, observe the roots. They should be white to tan, firm, and spread out. Black, mushy, or overly compacted roots can indicate problems.

**Flower and Fruit Development**

* *What to look for:* Monitor the budding, blooming, and fruiting stages. Any abnormalities, like dropped buds or fruit, can hint at potential issues.

**Pest Presence**

* *What to look for:* Check the undersides of leaves, along stems, and near the soil for any signs of pests like aphids, spider mites, or caterpillars.

**Signs of Disease**

* *What to look for:* Any unusual markings, mold growth, or decay can indicate the presence of a disease.

**Soil Condition**

* *What to look for:* The soil should be moist but not waterlogged. If it's too dry or consistently wet, it can be harmful to the plant.

**Environmental Factors**

* *What to look for:* Ensure that the plant is receiving the right amount of light, whether it's full sun, partial shade, or full shade. Also, check if there's proper air circulation, especially for indoor plants.

#### Tips for Effective Observation

* **Consistency is Key:** Make it a habit to check your plants regularly. This helps in early detection of any issues.
* **Use a Journal:** Document your observations. This can help you track patterns and changes over time.
* **Take Photos:** Periodic photographs can be beneficial to compare the growth and health of your plants.
* **Trust Your Instincts:** If something seems off or different, investigate further. Even if it turns out to be a non-issue, it's always better to be proactive.

By dedicating time to actively observe your plants and understanding what to look for, you'll be better equipped to ensure their health and well-being.

## Garden Journal 4: Fun with Garden Challenges!

**Objective**: Equip students to identify and comprehend common garden challenges, particularly pests and plant distress, by examining the changes observed in a head of lettuce placed in the garden during Week 3.

**Duration**: 15 to 20 minutes

**Instructions**:

1. **Reflection on Week 3 Activity**:
   * Begin by revisiting the Week 3 activity where a head of lettuce was placed outdoors. Discuss the various changes observed over the week, whether it attracted pests, experienced leaf drying, or showed signs of insect damage.
   * Emphasize the importance of consistent observation in gardening, akin to how doctors diagnose illnesses in people based on symptoms.
2. **Group Discussion**:
   * Divide students into small groups and provide them with cards or pictures showcasing different pests, diseases, and nutrient deficiencies (from the list provided).
   * Using the lettuce as a reference point, ask the groups to match any observed challenges on the lettuce with the cards they've been provided.
3. **Identification Task**:
   * Each group should identify the specific challenges they observed and discuss the associated symptoms. Facilitate discussion on whether they've seen these challenges in gardens, parks, or other green spaces.
4. **Journal Entry**:
   * **Sketch**: Students will illustrate one or two challenges they observed on the lettuce or found captivating from the cards.
   * **Describe**: Outline the symptoms and effects on plants.
   * **Reflect**: Share any personal experiences or encounters with these garden challenges, especially focusing on the lettuce experiment from Week 3.
5. **Research Element**:
   * Encourage students to delve into school resources, books, or safe online sources to uncover natural remedies to counter these challenges.
   * They should jot down one or two methods in their journal, emphasizing eco-friendly and sustainable solutions.
6. **Class Sharing**:
   * After the journaling activity, have each group present their observations, sketches, and findings. This collaborative approach can foster a deeper understanding and appreciation for gardening and its challenges.

**Note**: Teachers should closely supervise the research segment to ensure students garner accurate and safe knowledge.

***Handouts and Video***

* *Share and Discuss "Garden Journal Entry 4"*

## Materials

* Plant left out for the week.
* Items planted in week 2, for supplimentary observations.
* Items planted in week 3, for supplimentary observations.