

Hungry Plants

Grade Level: 6-12

Essential Skills: 1, 2, 4, 5

NGSS: MS-LS1-5, MS-LS2-5,
MS-LS1-4, HS-LS2-4

CCSS: WHST.6-8.1, WHST.6-8.2,
SL.8.1,

Time: 90 minutes

Materials: Soil Testing Kit*

- Jar with lid per group
- One nitrogen, phosphorus and potassium comparator with capsules.*
- One pipette*
- paper cups
- Activity Page: Hungry Plants per student
- Plant Nutrients Background Reading Page per student
- Hungry Plants Exit Ticket per student
- Paper Towel
- 3 Poster Size Papers
- 3 sticky notes per student
- One Set of Plantionary Cards (6 cards)

***Materials Available from Oregon Agriculture in the Classroom.**

[AITC Library Resources:](#)

More Lessons:

Soil Nutrients N-P-K
Fertilizers and the Environment
Know your Nitrogen
Soil Horizons & Oregon's State Soil
Water Filtering and Soil
From Rocks to Soil
Earth as an Apple & Soil Conservation

Description:

Students will discover that plants, like humans, need an adequate amount of nutrients to grow and stay healthy. Plants require 16 chemical elements for growth and development. Some nutrients come from the air while others are taken from the soil. It's important to test soil regularly to determine if there are enough nutrients to support plant growth. The soil test kit will help students identify whether the soil sample is fertile or deficient in nutrients. Keep in mind that all plants need nutrients, but requirements vary depending on the type of crop, shrub, tree, etc.

Background:

Most soils have an abundance of nutrients, but sometimes nutrients can be diminished or become depleted when they are not replaced after being used up by a plant. Nitrogen, phosphorus and potassium (N-P-K) play a vital role in plant growth. Nitrogen is important for growth, phosphorus stores and transfers energy to be used for reproduction and developing root systems and potassium is responsible for disease resistance. Nutrients can be replaced by adding manure, fertilizer, organic matter or compost to the soil.

Directions:

Part I: Preparing Soil Samples

1) Divide students into five groups. Have each group use a spoon or small shovel to gather soil samples in the paper cup. Ensure they avoid touching the soil with their hands, as this may alter test results.

Teacher Note: Encourage each group to get a sample from different areas in the garden or around trees and shrubs in order to have the best overall representation of soil nutrients.

2) Dump the soil out on a paper towel to allow soil to dry naturally if needed. Use this time to break up clumps and remove small stones before testing.

3) Place 1/4 cup of soil into a clean jar and add 1 1/4 cups of distilled water.

4) Place the lid on the jar and shake or stir the soil and water continuously for one minute.

5) Using a piece of masking tape, label the jar with the names of students in the group.

6) Set the mixture aside and allow it to stand until it settles. This usually takes 30 minutes to 24 hours depending on the type of soil.

7) Have students refer to the worksheet and hypothesize if each test will result in soil being depleted, deficient, adequate, sufficient or in surplus amounts for each nutrient.

Part II: "Plantionary"

1) Divide students into five groups. Explain to students that they will be playing a quick game of plant Pictionary or "Plantionary". Each group will identify a person in

their group to be the artist, the rest of the group will be guessing. Each group will receive a different word related to plant needs. Explain that you will be timing them and they have 65 seconds to guess their word. The first group to guess correctly should raise their hands when they are done.

2) Once groups are set up and the artist has been identified, distribute one plant plantiary card to each group. Have the artist of the group keep the card face down until you say "go". Once you say "go" the artist will flip the card, read it and return it to its face down position on the table before starting to draw.

3) After the time has ran out, have each group report to the class what their word was, take this time to make connections to why that word is important for plants.

Part III: Gallery Walk Posters

- 1) Hang three poster-sized papers around the room, write one of the following questions on each poster.
 - What do plants need for growth and development?
 - What are the sources of plant's needs?
 - What is fertilizer?
- 2) Provide each student with 3 sticky notes, instruct students to visit each poster, write an answer for the question on one of their sticky notes and place it on the poster beneath the question.
- 3) After students have distributed their sticky notes, review each question and the students' answers with the class. Explain that today, they will be learning about each of the concepts listed on the posters.

Part IV: Plant Nutrients & Soil Testing

- 1) Distribute the Plant Nutrient Background Reading Page to students.
- 2) As a class, read through the plant nutrient information. Explain to students that farmers and gardeners often have to supplement nutrients to plants through nutrient-rich plant foods as fertilizers to increase the primary macronutrient levels in the soil. Today, they will be testing soil for those very important primary macronutrients.
- 3) Provide each group with their testing kits and have them carefully collect their soil sample. Making as little movement as possible, have students take their sample back to their group and avoid disturbing the settled soil.
- 4) Have students select the appropriate comparator and matching capsule for each test. For example, students will use the purple capsule to test the amount of nitrogen in the soil. The nitrogen comparator has a purple cap and chart.
 - Purple = Nitrogen
 - Blue = Phosphorus
 - Orange = Potassium
- 5) Use the pipette to fill both the test and reference chambers with liquid from the soil and water mixture. Do not include sediment. Make sure to fill the comparator to the marked line.
- 6) Work with a partner, one holding the comparator with the liquid and the other partner should carefully separate the two halves of the appropriate capsule and pour the powder into the test chamber. (Hint: lightly squeeze one side of the capsule and twist the other side to gently pull apart the capsule.)
- 7) Put the cap back on the comparator, making sure it's sealed. Shake thoroughly.

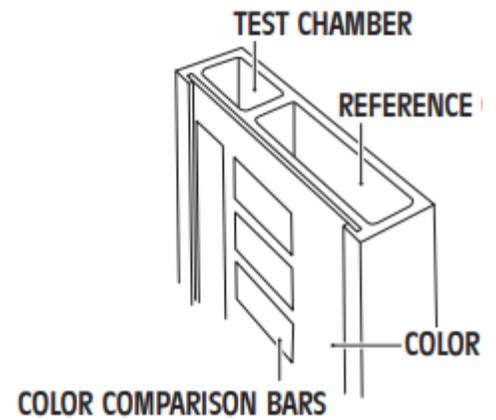


Fig.1. Comparator Diagram: Leaf Luster Products, Inc. "rapitest Soil Test Kit instructions." p.1.

- 8) Wait 10 minutes for the color to develop. If the blue color has settled to the bottom of the phosphorus test chamber during the 10 minute period, shake the tube to remix the color into the solution.
- 9) Compare the color of the solution in the test chamber against the chart and solution in the reference chamber. Repeat steps 2-7 for the nitrogen, phosphorus and potassium test.
- 10) Have students record their results in the chart provided on the Hungry Plants worksheet and complete the review questions at the bottom of the worksheet.
- 11) Discuss the review questions at the bottom of the worksheet as a class.

Part V: Exit Ticket

- 1) Distribute the exit tickets to students at the end of the class discussion to help review key concepts of the day and assess student learning from the lesson.
- 2) Have students complete the exit ticket after all materials and reference materials from the class have been put away.

This lesson was adapted from the materials of the following groups:

Luster Leaf, [Rapitest Soil Test Kit](#)

Natural Resources Conservation Service

Maintaining a Healthy Lawn in Western Oregon, Oregon State University Extension Service

North Carolina Department of Agriculture and Consumer Science, Plant Nutrients



Hungry Plants

Student Name: _____

In this activity, you will test the nutrient levels of the soil provided. Determine whether the soil's primary macronutrients are sufficient or deficient. Follow the directions below to complete this lab.

Part I: Testing Nitrogen, Phosphorus and Potassium

1) Carefully grab your soil sample making as little movement as possible to avoid disturbing the settled soil.

2) Using the testing kit, select the appropriate comparator and matching capsule for each test. For example, you will use the purple capsule to test the amount of nitrogen in the soil. The nitrogen comparator has a purple cap and chart.

- Purple = Nitrogen
- Blue = Phosphorus
- Orange = Potassium

3) Use the pipette to fill both the test and reference chambers with liquid from the soil and water mixture. Do not include sediment. Make sure to fill the comparator to the marked line.

4) Work with a partner, one holding the comparator with the liquid and the other partner should carefully separate the two halves of the appropriate capsule and pour the powder into the test chamber. (Hint: lightly squeeze one side of the capsule and twist the other to gently pull apart the capsule.)

5) Put the cap back on the comparator, making sure it's sealed. Shake thoroughly.

6) Wait 10 minutes for the color to develop. If the blue color has settled to the bottom of the phosphorus test chamber during the 10 minute period, shake the tube to remix the color into the solution.

7) Compare the color of the solution in the test chamber against the reference chamber's chart. Record your test results in the chart below. Repeat steps 2-7 for each nutrient: nitrogen, phosphorus and potassium.

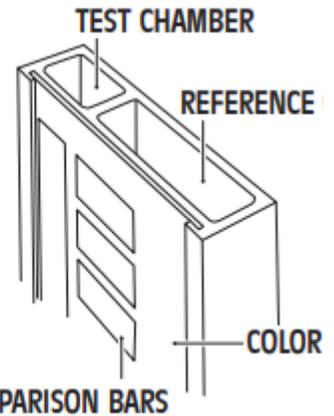


Fig.1. Comparator Diagram: Leaf Luster Products, Inc. "rapitest Soil Test Kit instructions." p.1.

Nutrient	Color (What it looks like in the Comparator after adding the capsule)	Test Results (Depleted, Deficient, Adequate, Surplus/Sufficient)
Nitrogen (N)		
Phosphorus (P)		
Potassium (K)		

Review Questions

1) Based on your test results, would the soil sample you tested be good for growing plants? Why or why not?

2) What steps could you take to ensure your plants are receiving the correct nutrient levels?



Background Reading

Plant Nutrients

Plants require 16 different nutrients in varying degrees for growth of development. Nutrients are supplied to plants from the air, through water and their roots and through fertilizers. Fertilizers are made up of several nutrients that plants need in varying combinations, similar to a protein smoothie for humans. Fertilizer gives plants a nutrient packed food.

Plant Nutrients



16 Chemical Elements

The 16 chemical elements plants require are categorized into two groups **minerals** and **non-minerals**.



Non-Minerals

Hydrogen (H)



Oxygen (O)



Carbon (C)



Photosynthesis

Using energy from the sun, plants create sugars and starches by converting carbon dioxide and water.

Minerals

Plants receive 13 minerals from soil through their roots. There are two categories that minerals are divided between based on the amounts needed by plants. See the categories below.



Macronutrients

Minerals needed in large quantities for plant growth and development.



Micronutrients

Minerals needed in small amounts for plant health.

Macronutrients

These are broken into two categories primary and secondary based on the amount needed and insufficient amounts in the soil.

Primary

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)

Secondary

- Calcium (Ca)
- Magnesium (Mg)
- Sulfur (S)



Micronutrients

Nutrients needed in very small or trace amounts for plant growth and development.

- Boron(B)
- Copper(Cu)
- Iron(Fe)
- Chloride(Cl)
- Manganese(Mn)
- Molybdenum (Mo)
- Zinc (Zn)

Plants need food!

Farmers and gardeners use fertilizer to supplement nutrients into the soil to nourish plants for optimum growth. Fertilizers use the 3 primary nutrients levels as a guide for their product.



N- Nitrogen (N)

P- Phosphorus (P)

K- Potassium (K)



Exit Ticket

Hungry Plants

Name: _____

- 1) What do the three letters on a fertilizer bag represent?
- 2) Why are fertilizers or other plant foods measured using the amounts of the above nutrients?
- 3) What are the sources of plants needs?
- 4) What is fertilizer?



Exit Ticket

Hungry Plants

Name: _____

- 1) What do the three letters on a fertilizer bag represent?
- 2) Why are fertilizers or other plant foods measured using the amounts of the above nutrients?
- 3) What are the sources of plants needs?
- 4) What is fertilizer?



Plantionary Cards



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Plantionary Cards



Plantionary Cards

Water

Air

Soil

Earthworm

Light

Bee