Science Literacy

Mighty Macronutrients

Grade Level
3-8

Length of Lesson
30 minutes

Objective
By the end of this lesson, students will understand the three macronutrients needed in the soil for plant growth and describe the effects of nutrient deficiency on plant growth.

Materials
- Student Worksheets
- Scissors
- Glue
- Pencils
- Colored Pencils/ Crayons/ Markers

Standards
Common Core
CCSS.ELA-Literacy.RI.3.1; RI.3.2; RI.4.1; RI.4.2; RI.4.7; RL.5.1

NGSS
3-LS4-3, 4-ESS2-1, 5-LS2-1, MS-LS2-1, MS-LS2-5

Lesson Summary
This lesson is designed to teach students about the three macronutrients needed in the soil for plant growth. Students will learn via reading comprehension and then test their knowledge with a matching game and an artistic assessment.

Suggested Sequence of Events:
1. Read *Under Your Feet: Soil, Sand, and Everything Underground* by Wenjia Tang to capture student interest.
2. Read through the IAITC Soil Ag Mag to learn more about soil! Interactive online versions can be found on our website.
3. Complete the activity following the procedures:
    - Pass out the student worksheets to each student.
        - The reading page (page 3) and the matching board (page 4) can be printed double-sided.
        - The matching pieces page (page 5) needs to be printed single-sided as the students will cut these up.
    - Depending on the age and ability level of your students, complete the reading page either as a class by conducting a read-aloud or having them read independently.
    - Once the reading page is completed, have students cut up the matching pieces on page 5 and use what they learned in the reading to place them correctly on the matching board (page 4).
    - Check students' work. Once the pieces are placed correctly, have students glue them into place.
    - As a review or an assessment, have students complete the coloring assessment page. Answer keys for all pages are included.
4. Whole class discussion and reflection of activity.

TEACHER RESOURCES

Extension Ideas

- For older or more advanced students (or if you do not have access to scissors and glue), do not give them the matching pieces to cut out. Instead, have them write the correct answers into the matching board.
- Learn about the specific levels of each nutrient needed for growing specific plants.
- Test the soil in your area to determine its nutrient availability using a RapiTest Soil Test Kit or something similar.
- Research amendments that can be made to the soil to adjust nutrient levels using compost or fertilizers.
- Conduct experiments using soil in your area to test plant growth under certain nutrient levels.
- Visit nearby gardens or fields and look for nutrient deficiencies in mature plants.
- In addition to the three macronutrients, learn about the eight micronutrients needed for plant growth: boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn) and nickel (Ni).
- Read more Soil-related books from our Scoop on Soil Recommended Reading list.
- Go to agintheclassroom.org to contact your County Ag Literacy Coordinator for free classroom sets of our Ag Mags!

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STUDENT WORKSHEET

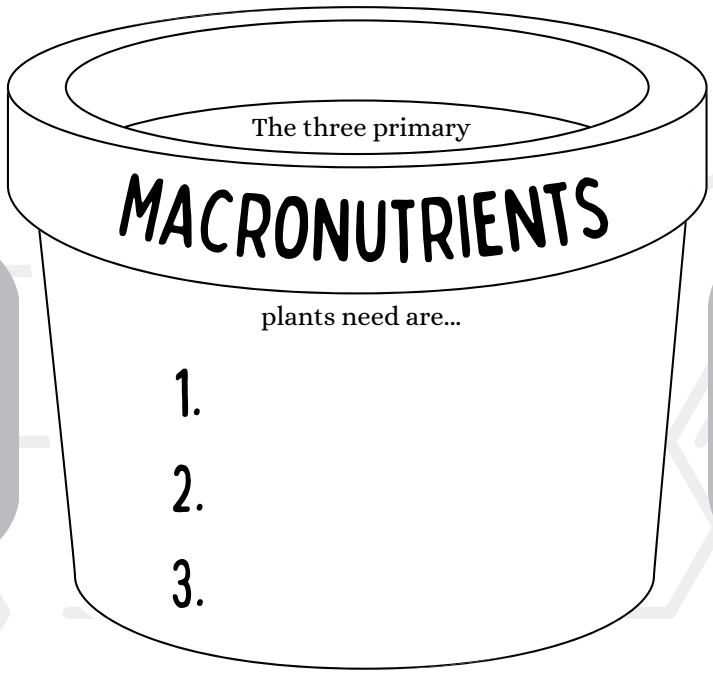
Directions: Read the text below. Use it to fill out the flower pot on this page and complete the matching board on the next page.

All living things need a variety of nutrients to survive. Humans and animals get nutrients by eating and drinking. Plants get nutrients by *absorbing* them through their roots from the soil they grow in. The three main nutrients, called **Macronutrients**, that plants need are Nitrogen (N), Phosphorus (P), & Potassium (K).

Plants need **Phosphorus** for development of roots and production of flowers. All plants need roots to uptake water and nutrients, and flowers to reproduce. If the soil is *deficient* in Phosphorus, the plant will have a weak root system and very few flowers and fruits. They may also have a purple coloring on their leaves.

Nitrogen is important for production of chlorophyll, which gives plants their dark green color and promotes photosynthesis. If a plant is growing in a soil that is *deficient* in Nitrogen, you may see a pale-yellow coloring on the leaves. The plant may also have stunted growth because it has not been able to photosynthesize.

The presence of **Potassium** in soil allows the plant to grow fast and strong. It also makes the fruits on a plant, and the seeds inside the fruit, look and taste better. If the soil is *deficient* in Potassium, there will be a brown coloring on the leaves and the fruits will not taste their best. The plant will also suffer from slow growth.



Macronutrients are chemical elements required in large amounts for plant growth.

Deficient means lacking or not having enough.

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Student Worksheet

Directions: Cut out the squares on the following page and try to match them to their correct spot on this board. When your teacher has checked them and they are all correct, glue them into place.

	STANDS FOR:	PROVIDES:	SIGNS OF DEFICIENCY:
N			
P			
K			

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Student Worksheet

Directions: Cut out the squares on this page and try to match them to their correct spot on the board on the previous page. When your teacher has checked them and they are all correct, glue them into place.

Potassium	Brown coloring on leaves, slow growth, and poor tasting fruits	Production of chlorophyll, which provides a dark green color to promote photosynthesis
Nitrogen	Pale yellow color on leaves, stunted growth from lack of photosynthesis	Quick plant growth and high quality fruit & seeds
Production of flowers and development of roots	Purple coloring on leaves, low quantities of flowers and fruit	Phosphorus

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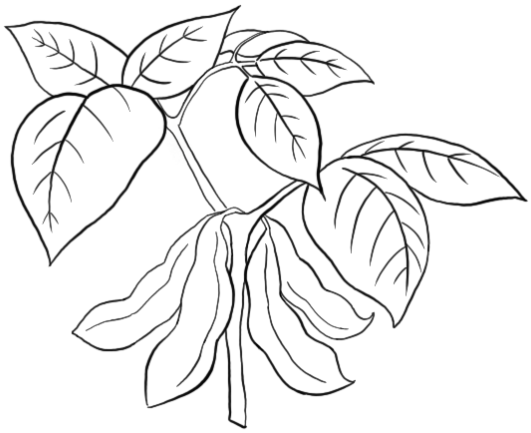
Student Worksheet

Directions: Color in the leaves on these soybean plants according to the descriptions about their soil nutrient levels. Then, answer the multiple choice question for each.

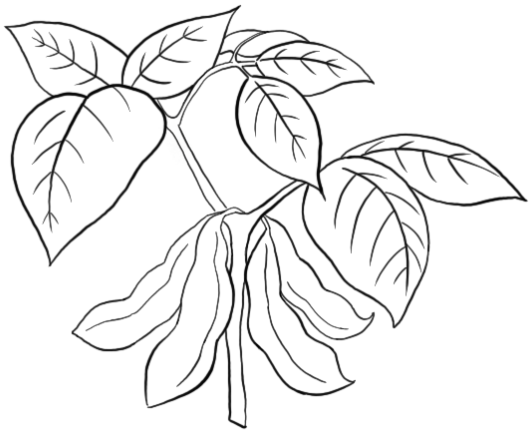
This soybean plant is growing in a soil that is *deficient* in **Nitrogen**. Color the leaves the correct color.



What does **Nitrogen** provide for the plant?

A. Production of roots and flowers
B. Quick plant growth & high quality fruits
C. Chlorophyll production for green color

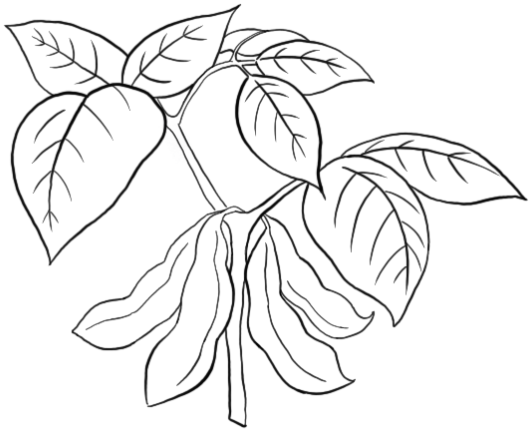
This soybean plant is growing in a soil that is *deficient* in **Phosphorus**. Color the leaves the correct color.



What does **Phosphorus** provide for the plant?

A. Production of roots and flowers
B. Quick plant growth & high quality fruits
C. Chlorophyll production for green color

This soybean plant is growing in a soil that is *deficient* in **Potassium**. Color the leaves the correct color.



What does **Potassium** provide for the plant?

A. Production of roots and flowers
B. Quick plant growth & high quality fruits
C. Chlorophyll production for green color

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ANSWER KEY

Directions: Cut out the squares on the following page and try to match them to their correct spot on this board. When your teacher has checked them and they are all correct, glue them into place.

	STANDS FOR:	PROVIDES:	SIGNS OF DEFICIENCY:
N	Nitrogen	Production of chlorophyll, which provides a dark green color to promote photosynthesis	Pale yellow color on leaves, stunted growth from lack of photosynthesis
P	Phosphorus	Production of flowers and development of roots	Purple coloring on leaves, low quantities of flowers and fruit
K	Potassium	Quick plant growth and high quality fruit & seeds	Brown coloring on leaves, slow growth, and poor tasting fruits

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ANSWER KEY

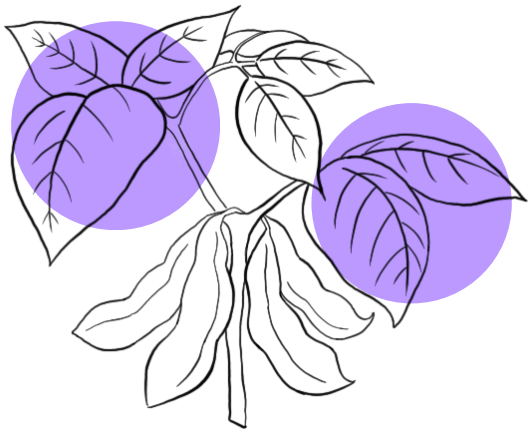
Directions: Color in the leaves on these soybean plants according to the descriptions about their soil nutrient levels. Then, answer the multiple choice question for each.

This soybean plant is growing in a soil that is *deficient* in **Nitrogen**. Color the leaves the correct color.

What does **Nitrogen** provide for the plant?

A. Production of roots and flowers
B. Quick plant growth & high quality fruits
C. Chlorophyll production for green color

This soybean plant is growing in a soil that is *deficient* in **Phosphorus**. Color the leaves the correct color.



What does **Phosphorus** provide for the plant?

A. Production of roots and flowers
B. Quick plant growth & high quality fruits
C. Chlorophyll production for green color

This soybean plant is growing in a soil that is *deficient* in **Potassium**. Color the leaves the correct color.

What does **Potassium** provide for the plant?

A. Production of roots and flowers
B. Quick plant growth & high quality fruits
C. Chlorophyll production for green color