



Unearthing America's Secret Past

Activity 2: Grades 5-8

Nutrient Depletion



As you learned in "[Thos. Jefferson, Slavemaster](#)," In the late 1700's, the role of the field slave evolved as landowners shifted from tobacco to wheat cultivation. Once a lucrative crop, tobacco gradually became a less and less profitable crop, in part because harvesting tobacco year after year stripped the soil of nutrients. When the concept of crop rotation was introduced, the plantation soils regained some lost vitality.

All plants require nutrients to grow and thrive. These nutrients are found in the soil and absorbed through the plants' root systems. Dissolved in water, the nutrients are distributed throughout the plant via its system of water carrying vessels. When the plants are harvested, they take the nutrients with them and the soil becomes depleted of these essential components. In this activity, you'll observe nutrient depletion as you germinate and grow nutrient-demanding seedlings.

This activity page will offer:

- opportunity to germinate and grow seedlings
- experience in determining soil nutrient levels
- operational definition of nutrient depletion
- understanding of the advantages of crop rotation

MATERIALS

- Corn, sunflower or winter rye seeds*
- Two small cups
- Nutrient testing kit (available at local garden supply stores) Potting soil
Water

*Although almost any seed can be used, the seedlings of these plants place high nutrient demands on the soil.

PROCEDURE

1. Obtain a small bag of potting soil. Mix well so that the soil is of uniform consistency.
2. Examine the soil testing kit supplied by your instructor. What characteristics of the soil can you test? (Accept all reasonable answers such as pH, nitrogen, phosphorus, and potash levels)
3. Select the soil nutrients that you wish to monitor. Set aside an appropriate amount of soil to perform these tests.
4. Analyze the soil and record the levels for each monitored nutrient.
5. Once you know the identity of the seed you will use, research the plant. In addition to uncovering the best way to grow seedlings, find out how the plant is cultivated as a cash crop.
6. Fill two small cups with potting soil. Follow the planting instructions printed on the seed package. Use your finger to poke holes into the soil. The holes should extend to the depth at which you will bury the seeds. Add seeds to each hole. Cover with soil.
7. Water and maintain the germinating seeds as suggested by your teacher or seed packet instructions.
8. After two weeks, the seedling should extend upward from the soil surface. Select one seedling cup and remove two samples of soil. One sample should be taken from the edge of the cup where no rootlets can be found. The second sample should be obtained from soil that is found within the web-like network of roots. Test these samples for nutrient levels. Record your results.
9. Maintain the second plant for an additional two weeks. After this time, obtain two soil samples. One sample should be obtained from an area free of roots. The other sample should be obtained from within the matrix of rootlets. Test these samples for nutrient levels. Record your results.
10. When the activity is complete, clean your desktop. Be sure to dispose of the soil and seedlings as directed by your instructor.

Questions

1. What happened to the level of soil nutrients over time?
2. What might have caused the observed change in nutrients?
3. Was there a difference in the nutrient level from samples taken from between the root system and those taken outside the root system? Explain.

EXTENSIONS

George Washington Carver

Although well known for his work with peanut crops, George Washington

Carver was a proponent of crop rotation. Born into slavery, Carver became an eminent plant scientist who was interested in improving the life of Southern farmers. He advocated alternating crops with legumes such as peanuts which restore nitrogen to the soil. Suppose you were interviewing George Washington Carver on a TV talk show. What questions would you ask him about his life and research? Work with a team of students to develop a script in which this historic figure is interviewed by a modern day host. Students should provide the questions and answers for the script and then act it out.

Crop Rotation

In addition to replenishing nutrients, rotating crops can help control the population of destructive pests and diseases. Since many pests and microbes attack only one type of plant, a yearly change of crop offers a form of protection. Write a 2-minute radio script that encourages owners of vegetable gardens to use crop rotation. Explain the benefits of this strategy and how it can be used to increase soil performance. To learn more about soils, contact a local nursery, gardening center, or perform an Internet search using key terms such as "soil nutrients" and "garden fertilizers."

Local Soil Testing

How healthy are local soils? Have an adult collect soil samples from different locations around your school. Obtain samples from places that include flower gardens, playing field, potted plants, and cracks in pavement. Test these samples for nutrient levels. Which ones have the highest load of nutrients? Which ones are poorest in nutrients? Can you explain your findings and relate nutrient level to physical, chemical, and biological parameters?

WEB CONNECTION

[The Agricultural Revolution: A Four Field System](http://www.saburchill.com/history/chapters/IR/003fp.html)

<http://www.saburchill.com/history/chapters/IR/003fp.html>

An essay on four-year crop rotations that were practiced during medieval times

[Tobacco to Wheat](http://www.mountvernon.org/pioneer/farms/tobacco_to_wheat.html)

http://www.mountvernon.org/pioneer/farms/tobacco_to_wheat.html

A site that surveys the plantation and agricultural strategies used by George Washington. It includes a yearly crop rotation schedule.

[Introduction to Colonial African-American Life](http://www.history.org/Almanack/people/african/aaintro.cfm)

<http://www.history.org/Almanack/people/african/aaintro.cfm>

An introduction to the colonial African American life as presented by the Colonial Williamsburg Foundation.

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Activity 2 **Nutrient Depletion**



Questions

1. What happened to the level of soil nutrients over time?
(The nutrient level dropped as the experiment progressed. Students should be able to provide evidence through their data)
2. What might have caused the observed change in nutrients? **(The plant removed the nutrients from the soil and incorporated these essential chemicals into new plant tissue.)**
3. Was there a difference in the nutrient level from samples taken from between the root system and those taken outside the root system? Explain.
(Accept all reasonable replies such as after the first two-week period there was a noticeable difference. After four weeks the difference was less obvious. The nutrients were quickly drained from areas in contact with the growing rootlet system. As the

plant grew, the roots spread into the soil. In addition, watering the plants transported nutrients to the regions of the soil that were in contact with roots.)

CURRICULUM LINKS

Life Science:

- Plant growth and the role of nutrients and soils
- Plant anatomy
- Nitrogen cycle and the role of legumes
- Crop rotation

NATIONAL SCIENCE STANDARDS (Grades 5-8)

Science as Inquiry- Content Standard A

Students will conduct a scientific investigation that involves observation.

Life Science - Content Standard C

Students will investigate the structure and function of organisms.

Students will explore how organisms utilize and obtain nutrients needed.

Students will understand how abiotic factors, such as soil composition, can limit populations.