Activity–Plants in Soil

Standard III

Objective 3

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Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 3
Observe the basic components of soil and relate the components to plant growth.

Intended Learning Outcomes
1. Use science process and thinking skills.
2. Manifest science attitudes and interests.

Connections

Background

Plants are living things and have many of the same needs as humans. As plants grow, their development is influenced by light, water, mineral nutrients, and air. Plants absorb water and mineral nutrients through the plant's vascular system.

It is very important that you do not give students the impression that plants are "fed" from nutrients in the soil the same way a person is fed when they eat food. The "food" for plants comes from the air. The bulk of a plant's body is made from carbon dioxide from the air. Soil nutrients can be compared to a human taking a vitamin pill. You need the vitamin nutrients to stay healthy but the source of your energy and bodybuilding substances comes from somewhere else. In the case of plants, the bulk of nutrients come from air. A famous experiment showed that if you measure the weight of soil, plant an acorn seed, let it grow into a large tree, that the soil will only lose a very small amount of weight – nowhere near the weight of the tree. The weight of the tree came from the air and to a much smaller degree, water.

The reason hydroponics (growing plants in a water solution) is successful is that plants really don't need soil to grow. Soil helps plants to stay upright, provides mineral nutrients and stores water but it does not feed the plant. Plants will grow on paper towels or in a dish of water.

Invitation to Learn

Explain to the students that plants need water and nutrients from the soil to survive. Plants take in water and mineral nutrients from their roots through their stems. It is similar to drinking liquid from a straw. When plants take in water from the ground, they are also getting some of the nutrients they need from the soil. Tell students that only a small part of the plants' nutrients come from the soil. The largest part of plant nutrients comes from air. The nutrients in the soil are like "vitamin pills"

for plants. There is a way to watch how water travels up the stems of plants using pieces of celery. The nutrients, which come from the soil, are dissolved in water and absorbed through a plant's roots. There are not always enough of these nutrients in the soil for a plant to grow healthy. This is why fertilizers are added to the soil to ensure the growth of plants.

(You could show the students a bottle of vitamins. The nutrients in the pills contribute to their health. But their body cannot grow and survive on just pills. People need to eat plant and animal material in order to grow. Plants do not "eat" the soil they grow in. They get their body-building food from the air.)

Instructional Procedures–Part 1

1. Fill a large bowl or basin with water.
2. Place the celery stalks in the water and use a knife to cut away the lowermost part of the stalk while it is under water. The cutting is done underwater so that air bubbles cannot enter the stem. Put the drinking glass in the bowl of water and transfer the celery stalk under water and into the glass.
3. Repeat procedure with second stalk of celery. Use a kitchen syringe to remove all but 3-4 cm of water in each of the glasses.
4. Add enough red food coloring to one glass to make the liquid very dark and save the other glass and celery stalk (the control example) to use for comparison later.
5. Assign students to write a hypothesis concerning what they thing will happen to the two celery examples and why.
6. Leave the stalks for several hours.
7. Check periodically until you can see evidence of color in the veins of the celery leaves.
8. Once you have detected the presence of the red food coloring in tips of the leaves of the experimental stalk, remove it from the water and place it on a cutting board.
9. Using a knife cut away approximately 3 cm from the lower end of the stalk.
10. Show the cut piece to the students and ask if they can see where the red food coloring has moved up the stem.
11. Continue to cut the stem in 3-cm pieces and follow the path of the colored water up the stem. Cut all the way up to the leaves.

Materials

- ❑ 2 fresh stalks of celery with leaves
- ❑ Bowl or basin
- ❑ 2 glass drinking glasses
- ❑ water
- ❑ knife to cut celery ends (for teacher use only)
- ❑ red food coloring (red is the best color to use for this activity)
- ❑ cooking syringe (baster)
- ❑ cutting board
- ❑ magnifying glasses
- ❑ science journals

12. Using a magnifying glass to examine the leaves, try to see where the water enters the veins of the leaves.
13. Cut the second piece of celery (the control example) and compare to the colored pieces of the cut celery. Students should write the results of the experiment using drawings and sentences. They should write their conclusion

Instructional Procedures–Part 2

Materials

- ❑ Seeds (bean or radish work well and grow quickly)
- ❑ Small bowls or other containers
- ❑ Various kinds of materials to use for structural support
- ❑ Student log or journal

Emphasize that plants do not need soil to grow. They use it for structural support. In other words, soil helps plants to stay upright. Soil is a medium for providing mineral nutrients and water but plants could obtain that without soil

Have students brainstorm different kinds of materials that plants could use for structural support. Some materials include floral foam, wet crumpled newspaper, wet gravel, paper towels, and cotton balls.

Have students design an experiment to show that plants grow without soil and to see what materials can be used for structural support.

1. Soak the seeds overnight.
2. Place seeds and growing medium in container.
3. Make sure medium is damp. Seeds need to be kept moist but should not sit in water.

   (Keeps seeds out of direct sunlight. They do not need it to sprout and the sun will hasten evaporation.)
4. Have students record all steps of the experiment in their log or journal

Curriculum Integration

Math/Science—Measuring to the nearest 1/4 inch

Possible Extensions/Adaptations/Integration

*Try this experiment using different types of white flowers to see which ones are the thirstiest.

- Make a multicolored flower by splitting the stalk of a white flower in two up the middle. Fill two glass containers with different-color dyes. Place 1/2 of the stalk in the one vase and one-half in the other.

- Using white carnation, create various bouquets for holidays using this method.
- Grow seeds under different conditions (temperature, light, heat, etc)

Homework & Family Connections

Raise sprouts for salad. Sprouting seeds can be found in many grocery stores and health-food stores. (Combinations of alfalfa and radish are tasty.) Soak one tablespoon of sprouts in water overnight. Drain and put in a one-quart jar. Cover the top with a piece of mesh or cheesecloth fastened with a rubber band. Turn upside down. Rinse sprouts twice a day. Sprouts will be ready to eat in 4-5 days. Keep them out of the sun.

Name_____

Observing the upward movement of water and mineral nutrients in a plant

Plants are living things and have many of the same needs as people do. As plants grow, their development is influenced by light, water, mineral nutrients, temperature, and air.

Plants, however, get their food in a very different way from people. People get their food by eating plants and animals. Plants get their food from certain gasses (dioxides) in the air. Plants absorb water and mineral nutrients through their roots and stem system. But that is like people who drink water and take vitamin pills. Plants are able to grow and get big – not from the minerals in the soil but from the air.

A famous experiment proved this. Scientists weighed an acorn and the soil it was planted in. The acorn grew into a large tree. The scientists weighed the soil and tree. The soil basically weighed the same. The plant got its weight from the air and sunlight. The water with the soil minerals helps plants stay healthy but plants can grow without soil. Soil provides minerals and stores water for plants to use. But soil does not feed plants.

Soil provides structural support for plants. In other words, soil helps plants stay upright.

Plants can grow without soil as long as they have something for their roots to hold onto and can get water.

Part 1

You can observe water nutrients traveling up the stems of plants using celery stalks. The celery sticks will be put into a glass with red food coloring. When you see red in the leaves it will be time to examine the celery stick. You will use a hand lens to help you see the path of the red food coloring as it moved up the stem. Examine the leaves and try to see where the colored water enters the veins of the leaves.

Record the results of this experiment by drawing pictures of the celery. Use a red crayon or pencil to show the path the water took. Use labels on your diagram.

Part 2: Research ways to grow plants without soil

Remember that plants do not need soil to grow. They need something for their roots to hang on to. And they do need water and the nutrient minerals that are usually found in the soil. If you put fertilizer in water and provide structural support (something for the plants roots to hang on to) the plants will grow fine.

Some structural support materials might include wet gravel, paper towels crunched up, cotton balls, or floral foam from a flower shop. Can you think of other materials?

My question is: Will plants grow in _____

My hypothesis is: _____

My experiment to prove my hypothesis:

Materials:

The kind of seeds I planted: _____

The kind of material I used for structural support: _____

Procedure: These are the steps I took:

_____

_____

_____

_____

_____

Results: This is what happened.

(Record which days you observed your plants. Write a statement telling how big your plant is and what it looks like – how many leaves, what color, etc)

Day	Height	Appearance

Conclusion: Write a statement that answers your question. You might add other facts that you learned.

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Rocks, Minerals, and Soil

Reference and Literature Books:

Eyewitness Books: Rocks & Minerals by Dr. R.F. Symes
Dorling Kindersley ISBN 0-7894-5804-7
Eycwitness Books: Crystals & Gem by Symes and Harding
Dorling Kindersley ISBN 0-7894-5764-4
How the Earth Works: 100 Ways Parents and Kids can Share the Secrets of the Earth
by John Farndon Reader s Digest ISBN 0-89577-411-9
The Best Book and Fossils, Rocks, and Minerals by Chris Pellant
Kingfisher ISBN 0-7534-5274-X
I Wonder Why Stalactities Hang Down: and other Questions About Caves
by Jackie Gaff Kingfisher ISBN 0-7534-5573-0
Let s Go Rock Collecting by Roma Gans
Harper Collins ISBN0-06-445170-4
Pockets: Rocks & Minerals by Sue Fuller
Dorling Kindersley ISBN 1-56458-663-4
Pockets: Earth Facts by Cally Hall and Scarlett O Hara
Dorling Kindersley ISBN 1-56458-891-2
Smithsonian Handbooks: Rocks and Minerals Chris Pellant
Dorling Kindersley ISBN 07894-91060-0
First Field Guide: Rocks and Minerals National Audubon Society
Scholstic ISBN 0-590-05484-8
The Field Guide to Geology by David Lambert
Facts on File, Inc. ISBN 0-8160-3823-6
Fem & Mineral Guide: Where & How to Dig, Pan and Miner Your Own Gems & Minerals
By Rygle & Pedersen Gemstone Press ISBN 0-943763-38-X
How to Dig a Hole to the Other Side of the World by Faith McNulty
HarperCollins ISBN 0-06-443218-1
The Magic School Bus Inside the Earth by Joanna Cole & Bruce Degen
Scholastic ISBN 0-590-40760-0
Everybody Needs a Rock by Byrd Baylor
Simon & Schuster ISBN 0-689-71051-8
When Clay Sings by Byrd Baylor
Simon & Schuster ISBN 0-689-71106-9
The Other Way to Listen by Byrd Baylor and Peter Parnall
Simon & Schuster ISBN 0-689-81053-9

Website:

Rock Hounds www.fiedu/fellows/payton/rocks/index2.html
(Franklin Institute Wired School)