

TRB 4:3 - Investigation 7 - Plants in Soil

Summary

Students will understand how the components of soil effect plant growth.

Group Size

Large Groups

Materials

Activity 1 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

Activity 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

Additional Resources

See the attached list of books that would help with this investigation.

Background for Teachers

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 grown 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.

Intended Learning Outcomes

1. Use a Science Process and Thinking Skills
2. Manifest Science Interests and Attitudes

Instructional Procedures

Pre-Assessment/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

Activity 1

Fill a large bowl or basin with water.

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.

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.

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.

Assign students to write a hypothesis concerning what they think will happen to the two celery examples and why.

Leave the stalks for several hours.

Check periodically until you can see evidence of color in the veins of the celery leaves.

Once you have detected the presence of the red food coloring in the tips of the leaves of the experimental stalk, remove it from the water and place it on a cutting board.

Using a knife cut away approximately 3 cm from the lower end of the stalk.

Show the cut piece to the students and ask if they can see where the red food coloring has moved up the stem.

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.

Using a magnifying glass to examine the leaves, try to see where the water enters the veins of the leaves.

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.

Activity 2

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.

Soak the seeds overnight.

Place seeds and growing medium in container.

Make sure medium is damp. Seeds need to be kept moist but should not sit in water. (Keep seeds out of direct sunlight. They do not need to sprout and the sun will hasten evaporation.)

Have students record all steps of the experiment in their log or journal.

Extensions

Math-

Measuring to the nearest 1/4 inch (*Standard IV, Objective 2*)

Science-

Try Activity 1 using different types of white flowers to see which ones are the thirstiest. (*ILO 1*)

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 1/2 in the other. (*ILOs 1, 2*)

Using white carnations, create various bouquets for holidays using this method. (*ILO 1*)

Grow seeds under different conditions (temperature, light, heat, etc.) (*ILOs 1, 4*)

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.

Assessment Plan

Check the students' logs to see if they understand hydroponic vs. growing in dirt.

Ask the students questions of why hydroponics works just as well as dirt.

Have the students tell how growing plants in moist cloth supplies everything needed as if they were growing in dirt.

Authors

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