Magic Beans and Giant Plants

Grade Levels

3 - 5

Purpose

Students will plant seeds and make considerations on which conditions affect plant growth. They will design and conduct experiments using a problem-solving process and compare and contrast to understand the parameters which influence the hea and growth of living things.

Estimated Time

60

Materials Needed

- Teacher Material A--Class Results--one per teacher
- Handout A--Magic Beans Problem Solving--one per student
- Potting Mix
- 4" or 6" pots
- Notebooks
- Writing instruments
- Optional: Jack and the Beanstalk by Ann Keay Beneduce
- Optional: Unearthing Garden Mysteries: Experiments for Kids by Ellen Talmage
- Beans (pole beans such as limas or scarlet runners are best)

Essential File (map, chart, picture, or document)

- Activity Sheets (https://cdn.agclassroom.org/media/uploads/2014/06/21/Magic_Beans_and_Giant_Plants.pdf)

Vocabulary Word

photosynthesis: process by which green plants (and some other organisms) use sunlight to synthesize foods from carbon dioxide and water. Photosynthesis in plants generally involves the green pigment chlorophyll and generates oxygen as a byproduct.

Did You Know? (Ag Facts)

- Seeds are not the only means of plant reproduction. Some plants create offshoots of themselves in the form of bulbs, tubers corms, or rhizomes. This type of reproduction is called vegetative reproduction.
- A drupe is a fleshy fruit (e.g., apricot or cherry) that has a woody stone or pip that protects the seed.

Background Agricultural Connections

Like all living things, green plants have basic needs. If light, water, air, nutrients, and an adequate temperature range are not available, plants cannot thrive and grow. Light energy is required for photosynthesis, in which plants make sugars in the leave Light also triggers changes, particularly flowering, in certain plants. Water is necessary to carry dissolved nutrients into the pla through the roots. It is one of the key ingredients in the process of photosynthesis, and helps the plant release energy from stored food when needed. Water pressure in plant cells, which are 65 to 95 percent water, supports stems and leaves. Water transports nutrients and gasses into, around, and out of the plant. It is an important component in the cells of all living things Plants require two of the components of air. They use carbon dioxide to make food (photosynthesis), and they use oxygen, as humans and other animals, to release the energy from that food (respiration). Plants require mineral nutrients for growth, rep and proper functioning. Mineral nutrients are formed by the breakdown of rocks and other materials in the earth. While humar get these minerals from plants, animals, or in the form of supplements, plants take these minerals from the soil (dissolved in

water) or through fertilizers applied by humans. Although these minerals are important supplements for health and maintenan they cannot replace the sugars produced in the leaves, which can also be stored as carbohydrates, fats, and proteins.

Interest Approach - Engagement

1. Tell your students a version of the story, *Jack and the Beanstalk* or read the optional book.
2. Hand out some "magic" beans (*see materials*) and ask, "What do you think is the secret to growing tall bean plants?" Expla that although magic may have influenced the growth of Jack's plants, scientists do know that other important factors contribute to plant growth.
3. As a class, generate a list of general factors (light, temperature, water, growing space, etc.) that students think green plant need to stay alive. Label it "All Green Plants Need."
4. Next to each factor, ask students to predict what specific conditions they think might result in the tallest bean plants. For example, if sunlight is a factor perhaps students predict ten hours per day. Accept all student suggestions whether or not y think they are correct. If students need help finding ideas, have them look through *Unearthing Garden Mysteries: Experiments for Kids* by Ellen Talmage.
5. Ask students how they might explore which of these conditions would help grow the tallest bean plants.

Essential Questions:

1. What do plants need for survival?
2. What happens to a plant when any of its needs are limited?
3. How does a farmer apply this knowledge (of what plants need) when he/she is growing a crop?
4. How might limitations of nutrients, sunlight, or water (plant needs) affect a farmer's profit?
5. How might limitations of nutrients, sunlight, or water (plant needs) affect a consumer's price for the product?

Procedures

Summary of Content and Teaching Strategies

1. Challenge small groups of students to choose one of the predicted factors for growing the tallest bean plants generated in t interest approach (light, water, temperature, good soil, etc.). To test predictions, have each group of students design an experiment, lasting up to four weeks.
2. Use Handout A to help guide the learning process. Students use notebook paper to record regular observations. (Younger children will need help setting up experiments, observing, and recording data.) Example work process: Group A and B migh each have two plants. The plants in Group A get 24 hours of light while the plants in Group B, the control, get 14 hours of light. A control is used to minimize the effects of variables other than the one being tested. In this example the control is 1 hours of light because plants receive roughly 14 hours of light a day during the summer months.
3. Before groups of students set up experiments, have each group present its design for review by the class.
4. Have students explain why they predict their particular conditions will improve plant growth. For example, "We think 24 hours of light will make the beans grow taller in four weeks, because we know they need light to make food. So the more light, the more food, and the taller the plant." Have each group decide how they'll gather their data.
5. Suggest that at the end of each week students graph the daily growth rate of their plant and predict, based on the growth rate, how tall their plant will be by the end of the next week. On the graph, illustrate both predictions and actual growth rat results.
6. After four weeks of experimenting, have each older student group present a three-minute "news conference" to the class highlighting its findings. Suggest a title such as "Grade _____ Scientists Find That _____ May Have Contributed to Jack's Mammoth Beanstalk."
7. Have students use creative summary charts and graphs to present data.
8. Encourage other class members to review the findings and ask questions about the nature of the experiment, conclusions, etc. For example, "Why did you plant X number of seeds in each pot? How did you treat each of your groups? What might you do differently if you were to repeat the experiment? How do you know it was not _____ that affected your plants?"
9. Combine results from different experiments on a class chart. Use *Teacher Material A* if desired. Refer to the chart when discussing the Review/Summary questions.

Review the following questions with the class:

- Were there growing conditions the tallest plants seemed to have in common? What seemed to contribute most to the height of bean plants?
- Did any of your findings surprise you? Which ones?
- Did the tallest plants seem to be the healthiest plants? Explain your response. Do you think bigger is necessarily better? Wh or why not?
- How did the data from the whole group help give us a better understanding of conditions for good bean plant growth?

We welcome your feedback (https://usu.co1.qualtrics.com/jfe/form/SV_4HhIVpN4L8IC2lT)! Please take a minute to tell us how to make this lesson better or to give us a few gold stars!

Enriching Activities

- Devise an experiment to grow the smallest bean plant that will produce flowers.
- Replant beans harvested from your stalks. (Wait to replant seeds until pods have dried, about four weeks after the beans were ripe.) Notice whether the seeds from the biggest plants produce bigger offspring.
- Rewrite or act out a new version of Jack and the Beanstalk using some of the new information gained from your exploration Post these "techno-tales" around the room.

Sources

Adapted from the National Gardening Association's ***GrowLab Activities for Growing Minds***, second edition, copyright 2009. For more information on obtaining a copy of their curriculum visit their website (https://www.kidsgardening.org/).

Suggested Companion Resources

- Growing Letters! (https://www.agclassroom.org/matrix/resource/70/)
- What Do Plants Need to Grow? (https://www.agclassroom.org/matrix/resource/268/)
- First Garden (https://www.agclassroom.org/matrix/resource/198/)
- First Peas to the Table (https://www.agclassroom.org/matrix/resource/199/)
- How Things Grow (https://www.agclassroom.org/matrix/resource/273/)
- Kids' Container Gardening (https://www.agclassroom.org/matrix/resource/424/)
- Lily's Garden (https://www.agclassroom.org/matrix/resource/425/)
- Oh Say Can You Seed? (https://www.agclassroom.org/matrix/resource/1031/)
- Oliver's Vegetables (https://www.agclassroom.org/matrix/resource/457/)
- Our School Garden! (https://www.agclassroom.org/matrix/resource/988/)
- Plantzilla (https://www.agclassroom.org/matrix/resource/71/)
- Seed, Soil, Sun: Earth's Recipe for Food (https://www.agclassroom.org/matrix/resource/210/)
- Sylvia's Spinach (https://www.agclassroom.org/matrix/resource/1040/)
- The Amazing Life Cycle of Plants (https://www.agclassroom.org/matrix/resource/911/)
- The Curious Garden (https://www.agclassroom.org/matrix/resource/1009/)
- The Tiny Seed (https://www.agclassroom.org/matrix/resource/223/)
- Unearthing Garden Mysteries: Experiments for Kids (https://www.agclassroom.org/matrix/resource/68/)
- Weslandia (https://www.agclassroom.org/matrix/resource/598/)
- Farming in a Glove (https://www.agclassroom.org/matrix/resource/196/)
- Living Necklace Kits (https://www.agclassroom.org/matrix/resource/83/)
- Preserving Heirloom Crops with Wozupi Farms (https://www.agclassroom.org/matrix/resource/887/)
- Farm to Table & Beyond (https://www.agclassroom.org/matrix/resource/669/)
- GrowLab: A Complete Guide to Gardening in the Classroom (https://www.agclassroom.org/matrix/resource/688/)
- GrowLab: Classroom Activities for Indoor Gardens and Grow Lights (https://www.agclassroom.org/matrix/resource/687/)
- Math in the Garden (https://www.agclassroom.org/matrix/resource/674/)
- School Gardens: A Guide for Gardening and Plant Science (https://www.agclassroom.org/matrix/resource/283/)
- The Growing Classroom (https://www.agclassroom.org/matrix/resource/670/)
- Kid's Gardening Website (https://www.agclassroom.org/matrix/resource/191/)

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