

Oregon



Agriculture in the  
Classroom Foundation

**Developed By:**

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# Summer Ag Institute Lesson Plans

<b>Title of Lesson:</b>	<b>Hydroponic Plant Investigations</b>
<b>Academic Subject:</b>	<b>Science and Math</b>
<b>Theme:</b>	<b>Compare the growth rate of hydroponically grown plants to those grown in soil.</b>
<b>Grade Level:</b>	<b>4/5</b>

## **CIM/CAM Standards:**

1. Science, 5th grade—Describe the basic plant and animal structures and their functions.
2. Science, 5th grade—Ask questions and make predictions that are based on observations and can be explored through simple investigations.
3. Science, 5th grade—Design an investigation to answer questions or check predictions.
4. Science, 5th grade—Collect, organize, and summarize data from investigations.
5. Science, 5th grade—Summarize, analyze, and interpret data from an investigation.
6. Math, 5th grade—Select the appropriate units to measure length.
7. Math, 5th grade—Measure length, ....using standard and nonstandard units of measure.
8. Math, 5th grade—Collect, organize, display and analyze data using number lines, bar graphs, line graphs, circle graphs, stem and leaf plots, and histograms.

## **Learner Objective: (The student will)**

1. Identify the stages of seed germination.
2. Define the related vocabulary words and identify the location and functions of the major plant parts.
3. Understand the need to add nutrients to the water when growing plants hydroponically.
4. Write a scientific inquiry investigation to determine the effect that growing plants hydroponically has on their growth rate.
5. Identify questions that can be answered by their scientific investigation and write a hypothesis.
6. Recognize reasons for controlling variables.
7. Measure and record plant growth over a period of several weeks.
8. Create a line or bar graph showing the comparison data of the hydroponically and soil grown plants' growth rates.
9. Draw conclusions about their hypothesis based on the data they have collected and recorded.
10. Present their graphs and conclusions to the class.

## **Vocabulary:**

1. Hydroponics—the science of growing plants without soil.
2. Seed—the part of a plant that is responsible for starting a new plant.
3. Root—the underground part of a plant that anchors the plant, absorbs water and minerals, and stores food.
4. Stem—the part of the plant that holds it upright supporting flowers and leaves.
5. Leaf—an extension of the stem that turns sunlight into food through a process called photosynthesis.
6. Flower—The part of the plant that is responsible for producing seeds.
7. Fruit—the fleshy part of plants that holds seeds. The fruit is responsible for protecting and scattering the plants seeds.
8. Germinate—when a seed takes in water and begins to grow.

9. Phloem—plant tissue that transports food in the plant.
10. Nutrients—substances used by plants to make their food and make plant growth possible, made up of carbon dioxide, water and minerals.
11. Hypothesis—something not proved but assumed to be true until further investigation.

### **Anticipatory Set:**

Ask students, “What do plants need to grow?” and list their responses on the board. Ask students if they think plants can grow without soil. Explain that we will be learning about the science of growing plants without soil (hydroponics) and comparing them to plants grown in soil.

### **Instructional Outline (Teaching Content)**

1. Introduce students to vocabulary.
2. Review seed germination.
3. Explain hydroponic growing set up and identify the need for, content of, and process of adding nutrients for the plants.

### **Strategies (What to do, explain or have students do)**

1. \*Distribute vocabulary handout and read through it together. \*Have each student make a “flip book” study guide using the definitions from the handout. \*Flip books will be used throughout the following 1-2 weeks for independent study, partner quizzes, and class games to help students learn their vocabulary. \*At the end of the second week an independent vocabulary quiz will be given.
2. \*Divide students into three groups and distribute/ read the lesson worksheet on making a living necklace from the Oregon Agriculture in The Classroom Foundation. \*Have each group gather their supplies from the table and complete a necklace using a bean seed. \*Students may take turns wearing their group necklace or set it in a window. \*Necklaces will be checked in 4 or 5 days at which time the plant parts and germination will be discussed and then labeled on the germination worksheet.
3. \*Show students the hydroponic system and discuss its parts and their functions. \*Present information on the nutrients needed for successful hydroponic plant growth, using the Virginia Hydroponics article. \*Inform students that we will use fertilizer to provide complete nutrients for the plants since they will not be getting any nutrients from soil.

4. Planting seeds.
5. Introduce and facilitate the completion of the scientific inquiry investigation plan form.
6. Plant care.
7. Data collection and recording.
8. Plant measurement and data collection.
9. Display data in a graph.
4. Distribute seeds to each of the three groups, giving one group lettuce seeds, the second group basic seeds, and the third group tomato seeds. Have each group plant 3-4 of their seeds in soil containers and 3-4 of their seeds in their group's section of the hydroponic garden system.
5. \*Distribute the plan forms, which students should already be somewhat familiar with from previous science investigations. \*Complete the first two sections together discussing the questions we wish to answer in our investigation, the variables we will keep the same in order to conduct a "fair" investigation and the variables we will change. \*Have each group discuss and agree upon a hypothesis to write on the final section of the plan form.
6. After insuring that the only differences in the growing circumstances of the plants is soil vs. hydroponic system, have each group assist in the care of, and watch for progress in their plants' growth.
7. \*During this period of waiting for plant growth use lessons from the math text to practice collecting, recording, graphing and interpreting data. \*Also have students practice making accurate length measurements on various objects in inches and centimeters.
8. As plants begin to show above soil level have groups choose the one healthiest of each of their soil and hydroponic plants to use for data collection. \*Explain that these two plants for each group will be the same plants they measure each time in order to be collecting reliable data. \*Have each group measure their two plants and record the measurements and date, and label with soil and hydroponic in their science notebooks. \*These measurements and recordings will continue twice a week over the next several weeks.
9. Have each group create a poster size line or bar graph to show their comparison data on the rate of growth for their soil grown vs. hydroponically grown plants.

10. Evaluate hypothesis.
  10. \*Have each group use their data and graph to discuss and evaluate the accuracy of their original hypothesis concerning the soil grown vs. hydroponically grown plants. \*Have each student put his/her conclusions in writing on the final page of their investigation plan forms.
11. Group presentations.
  11. Have each group plan, practice and present their original hypothesis, graph and conclusions to the class.

### **Extensions:**

Read about and discuss the possible benefits of and uses of hydroponic farming in U.S. agriculture. This could even piggy-back into a research assignment or creative writing project related to hydroponic farming.

### **Closure:**

\*Display group graphs and conclusions.

\*As a class determine which of the plant types showed the greatest differences in growth.

\*If possible, take a field trip to the Davis Farm in Corvallis to see a hydroponic operation first hand.

### **Resources:**

1. Growing Edge Web Site: <http://www.growingedge.com/basics/start.html>
2. "Grow Your Own Vegetables Without Soil 1; University of Florida Extension article.
3. Virginia Hydroponics: [http://www.hydro4u.com/resource\\_center/faq.htm](http://www.hydro4u.com/resource_center/faq.htm)
4. "History of Hydroponics": <http://archimedes.galilei.com/raiar/histhydr.htm>
5. Davis Farm, Corvallis OR
6. "Living Necklace" lesson from Oregon Agriculture in the Classroom Foundation
7. "Seeds Stems And Such" lesson from Oregon 4-H Agriculture in the Classroom Curriculum Handbook for Grades 4-5, 2003
8. Hydroponic kit from SAI
9. Hydroponic supplies from: [www.americanag.com](http://www.americanag.com)
10. [kidsgardening.com](http://kidsgardening.com)

**Evaluation:**

1. Evaluate student notebooks for accuracy in recording plant measurements and growth records.
2. Evaluate student made comparison graphs of plant growth data.
3. Evaluate student science inquiry packets for their accuracy and completeness using the state scoring guide.
4. Evaluate student accuracy on vocabulary and plant part quiz.