

Growing With Hydroponics

Grade 8

► **Next Generation Science Standard: MS-ETS1-1**

Define a design problem that can be solved through development of an object, tool, process or system.

Application: Because of technological advancements such as hydroponics, farmers can extend the growing season of some fresh produce. Hydroponics is one out-of-the-ordinary idea for how to feed a growing world.

Materials for one hydroponic garden (optional project):

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| electric drill and attachment for cutting large holes | peat gravel |
| 18 gallon food-safe storage tub with a smooth flat lid | compass |
| 8 net pots (3.75 inches wide) | water |
| 12 inch aquarium stone | paper |
| aquarium air pump with tubing to connect to the aquarium stone | scissors |
| 8 small pepper plants | permanent |
| plant food (must contain micronutrients) | marker |

Introducing the lesson:

Farmers around the world grow the food we enjoy every day. There are three basic steps to get food from the farm to the dinner table:

- *Production* involves growing the food on a farm. With an increase in the world's population, farmers have discovered new ways to grow crops that make our food supply more sustainable. One example is hydroponics.
- *Processing* is what happens to the food once it is ready to be picked. This could involve packaging, canning, freezing, or drying it.
- *Transportation* involves taking the food to the store.

Did you know? Dirt is just, well, dirt, right? Nope! Dirt is made up of stones, sand, clay, and organic matter from decaying plants and animals. Here's the scoop:

- Climate has a major impact on your area's soil. Cycles of freezing and thawing help to break down rocks into smaller and smaller pieces.
- Topography (whether your area is flat or hilly) has an impact too. Flat areas tend to have deeper soil and hilly areas have more shallow soil.
- The amount of water in your soil is important because water carries nutrients. Soils with a lot of clay in them tend to hold water; soils with a lot of sand in them do not hold water.

The more we can protect our soil and preserve its nutrients, the more healthful crops we can plant to feed the world.

Lesson:

1. Discuss the fact that the world's population grows every day. In fact, by 2050 farmers need to increase food production by 70% to feed the world's people. Advances in food production techniques are one way to meet that need.
2. Ask students if they have ever heard of *hydroponics*. Explain that the word *hydroponics* means *working water* in Latin. Hydroponics involves growing plants without soil. **Ask students:**
 - With a growing world population, why would growing plants without soil be beneficial? *Soil is a limited resource. With hydroponics, foods that are not traditionally grown in specific areas potentially could grow there.*
 - Don't plants need soil to grow? Why or why not? *Not really. Soil anchors a plant's roots and supplies it with water and nutrients. However the farmer can do the same thing without soil. Because the plant doesn't expend energy growing extensive root systems to find food and nutrients, that energy can go into growth and fruit and flower production.*



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3. One way to help understand how hydroponics works is to create a hydroponic garden. Hydroponic gardens take many forms, so invite students to research and explore the options and share what they've learned with the class. *Optional: Follow the directions below to create a hydroponic garden at your school.*

Assembling a Hydroponic Garden

- Place the eight net pots upside down on top of the storage tub lid.
- Use a permanent marker to trace around the rim of each pot to outline where it will be placed.
- Next trace the rim of the net pot on paper and cut out the circle.
- Fold the circle into fourths to find its center.
- Snip off the tip (the center) of the folded circle to create a small hole.
- Open the circles and place them on top of the outlines on the storage tub lid. Use the permanent marker to draw a dot where the hole is.
- Use a compass to draw a circle about $\frac{1}{2}$ inch smaller inside each circle on the lid.
- Using the electric drill with an attachment for cutting large holes, cut out the inner circles in the lid of the tub. **(For safety reasons, this step is for adults only.)**
- Place the pots in the holes. They should fit snugly.
- Fill the storage tub with water. Make sure you know how many gallons the tub is. (Note: the weight of the water may cause the tub to bulge; the lid may not fit snugly.)
- Following the mixing guidelines, add the nutrients/plant food to the water.
- Now it is time to provide aeration to the nutrient-rich water. Attach the aquarium stone tubing to the air pump. Leave the air pump outside of the container and place the stone in the bottom of the tub.
- Gently* wash the root balls on each pepper plant to remove all dirt. Then place each plant in the center of a pot. Add peat gravel around the plants to anchor them.
- Place the pots into the lid of the container. Make sure that at least one inch of the plant is submerged into the water.
- Observe the root system and plants. Record observations in a science journal.

Think about it.

Growing plants without soil sounds crazy, right? Well hydroponics is just one idea for how we can grow more food without taking up more land. What other “just crazy enough that they might work” ideas can you come up with? Do some Internet research to find out if similar experiments have been conducted and, if so, what the results were!



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