

Can We Grow Plants Without Soil?

Grades: K - 6

Setup: 15 mins; Grow Time: 3 - 4 weeks



Lesson summary:

Students will discover how to grow plants without using soil in a system called hydroponics.

What's the big idea? ? ?

- Can I grow plants without soil?

Outcomes or purpose:

- Hydroponics is a way to grow plants without soil. Hydroponics meets all the plant's needs for L.A.W.N.S.

Teacher background:

What do plants need to survive? We use the acronym L.A.W.N.S. to remember that plants need light, air, water, nutrients and space. When we think of space for plants, we know that the parts of the plant growing above ground like stems and leaves need space to grow and should not be crowded. But plants also need space for their roots. What about soil? Plants grown indoors or outdoors have their roots in the soil. Don't plants need soil to survive?

Let's think about what soil does for plants. Soil is a space for plants to anchor their roots. Garden soil is made up of tiny particles of sand, silt and clay. Healthy soil is porous, which means that there are tiny little spaces in between these tiny particles of sand, silt and clay. Water and nutrients move between these spaces and is absorbed by the roots. We know from L.A.W.N.S. that plants also need air to survive. Plants take in air through their leaves and roots. Since air is also in the tiny spaces in soil, this is how the roots get air.

There is a way to grow plants without using soil called hydroponics. (Hydro is the Greek word for water.) Since plants still need something to anchor their roots into, soil is replaced with rockwool or cotton. (Rockwool is made from molten rock that is spun into fibers and then compressed into mats or cubes.) This growing medium is kept constantly moist. What is missing now are nutrients. That's why fertilizer is added to the water. In this way the plant gets a steady supply of the nutrients and water it needs for photosynthesis so it can make its own food. The last thing the roots need is air and that is where the straw comes in. By gently blowing into the straw, the students are aerating or putting air into the water which the roots can absorb.

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Materials needed:

You can use either CD jewel cases (with one clear side) or plastic ziploc sandwich bags to hold the seeds in this project. If using the CD jewel cases, a bit of plasticine helps to keep the case upright. If using plastic ziploc sandwich bags, simply pin the bags to a bulletin board using thumb tacks or tape them to the wall.

- Cotton balls or rockwool
- **Seeds:** Leaf lettuces like red sails, oak leaf or Grand Rapids work well. You can also try basil, water cress, pak choi, arugula and spinach
- Waterproof tray or shallow container
- One 500 ml plastic container with lid (per student, such as a repurposed margarine, cottage cheese or yogurt container)
- Plastic dome or clear plastic wrap
- Plastic drinking straw
- Utility Knife (for teacher use only)
- Spray bottle with water
- Water-soluble 20-20-20 fertilizer



Step by step instructions:

Prepare the containers with lids in advance for the students

1.

Use a utility knife to carefully cut a 2.5 cm X shape in the center of the lid.

2.

Cut a smaller 1 cm X shape in the lid, about 2 cm from the edge, large enough to insert a drinking straw.

Next Steps:

1.

Place cotton balls or small squares of rockwool in a waterproof tray or shallow container. Apply enough water to moisten the cotton or rockwool using the spray bottle.

2.

Press two or three lettuce seeds in each cotton ball or rockwool square.

3.

Cover the tray with a dome or clear plastic wrap to retain moisture and humidity until the seeds germinate. Check daily and spray with water as needed.

4.

After about 3 weeks, the seedling will have several leaves and be about 3 cm (1") tall. It is now ready to grow in the hydroponic container.

5.

Gently insert the cotton ball or rockwool with the seedlings halfway through the large X so that it is held securely in place in the lid.

6.

Prepare a solution of water and fertilizer. Add 1 gram (1/4 teaspoon) of fertilizer into 1 litre (4 1/4 cups) of water and mix thoroughly.

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7.

Fill the container with the fertilizer solution so that the very bottom of the cotton ball or rockwool square touches the solution, then secure the lid.

8.

Insert a drinking straw through the smaller hole into the solution. Twice a day, gently aerate the solution by blowing into the straw.

9.

Place the plants in a sunny window or under grow lights.

10.

Change the nutrient solution every 1 to 2 weeks.

11.

As the plant grows, harvest the outer leaves.

Discussion questions

- What surprised you about hydroponics?

