

Enriching Soil with Compost

Overview: Adding compost to soil can improve its structure and pore space and increase the nutrients available to plants. Growing plants with and without compost added to the soil allows students to explore the impact of compost on plant health and growth.

Grade Level/Range: 5th – 8th Grade

Objective(s): In this lesson students will:

- Learn about compost and how it is made.
- Explore the ways compost can help restore our soils.
- Devise a plan for encouraging composting at school, at home, and in their communities.

Time: 6 weeks

Materials:

- Compost (from an indoor worm bin, compost pile, or purchased from a garden center)
- Garden soil or potting soil without added nutrients
- Shallow bins and hand trowels
- Hand lens
- Planting containers, raised beds, or in-ground garden space
- Assorted seeds and/or plants
- Sensory Observation Worksheet
- Plant Growth and Observation Worksheet

Background Information:

Composting is the process of facilitating the decomposition of organic matter in a controlled setting. It is a technique gardeners and farmers use to recycle organic matter into a nutrient-rich material similar to the humus that is naturally created in the soil as organic matter decomposes.

Decomposition is an important process in our world. As living matter dies, organisms known as decomposers consume it, breaking it into smaller components that are then incorporated into the soil. The end product of the decomposition process in nature is called humus, composed of a complex mix of nutrient-rich, biologically stable kinds of organic matter. Humus helps create a beneficial soil structure for plants' roots and provides the nutrients needed for new plant life. Common decomposers include earthworms, insects, and smaller microorganisms like bacteria and fungi.

Compost is also decomposed organic matter, but it differs from humus in that it is created in a setting crafted by humans and is not decomposed to the exact same level. Gardeners collect organic materials such as leaves, grass clippings, and food scraps, then expose them to conditions that encourage microbial activity. By design, composting speeds up the decomposition process, so if conditions are right, the materials can break down faster than if left to decompose in nature. Adding finished compost to soil provides a number of benefits, including:

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- Increasing pore space in the soil to improve its structure and increase its air and water holding capacity, which is good for roots
- Contributing additional nutrients to soil in a readily available form for plant roots to absorb
- Fostering an increase in beneficial micro-organisms that strengthen the soil food web
- Stabilizing the pH (acidity or alkalinity) of the soil
- Promoting healthy plant growth

Incorporating composting into your garden program provides benefits beyond being an important soil amendment. It helps students learn about the nutrient and decomposition cycles. It decreases the amount of waste going to the landfill, conserving both space and decreasing costs. Additionally, it prevents the loss of nutrients and decreases greenhouse gas emissions.

For more information about compost and how to begin composting, check out the following KidsGardening articles:

Composting: <https://kidsgardening.org/resources/gardening-basics-composting/>

Worm Composting: <https://kidsgardening.org/resources/gardening-basics-worm-composting/>

Compost Your Way: <https://kidsgardening.org/resources/lesson-plan-compost-your-way/>

Troubleshooting Compost Problems: <https://kidsgardening.org/resources/gardening-basics-troubleshooting-compost-problems/>

Borage and Other Compost Plants: <https://kidsgardening.org/resources/growing-guide-borage-compost-plants/>

Laying the Groundwork:

Begin the lesson by allowing students to explore the differences and similarities between soil and compost using their senses. Divide students into small groups and provide each group with a shallow container filled with soil and a second container filled with compost. Also, provide them with a small trowel and hand lens to help with their exploration.

On the board or using easel paper, create headings for the senses: sight, smell, and touch, and then underneath, divide each into two columns labeled soil and compost. Give each group 5 to 10 minutes to explore both samples and ask them to brainstorm some words to describe their observations related to each of these senses. They can use scratch paper, or you can use the **Sensory Observation Worksheet** linked above.

After giving them time to explore, come together as a group and create a class list of observations for each. Ask students: *How are the two samples similar? How are they different?* Create a Venn diagram using the brainstormed descriptive words to help review your conclusions.

Use the Background Information to further explain to students the differences and similarities between compost and soil. If you need additional support related to soil, check out [All the Dirt on Soil](#).

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Exploration:

1. Set up an experiment to compare the growth of plants in compost-enriched soil vs. unamended soil. Depending on the space and time available, you can design this experiment in various ways:

- Indoor Plants – Use smaller (4"-6") pots, a potting soil mix without added nutrients and compost. Try different ratios of potting soil to compost, taking care to label the containers and record the mixture to help with analysis at the end.
- Outdoor Plants – Small Space Available – Use 6" to 8" pots or 5-gallon buckets with drainage holes drilled into the bottom filled with potting soil mix without added nutrients, along with various amounts of compost. As above, try different ratios of potting soil to compost.
- Raised Beds (or in-ground beds) – Raised beds and in-ground beds allow you to grow plants in natural soil rather than potting mix. Raised beds give you more control over the ratio of soil to compost. If you decide to use an in-ground bed, your treatment will be defined by the amount of compost added.

2. Choose seeds or plants. If time is limited, choose fast-growing plants, such as beans (plant from seed), tomatoes (plant from seeds or transplants), or marigolds (use transplants). To ensure the most meaningful results, limit the variables in the experiment by planting seeds at the same time or selecting plants that are approximately the same size, age, and health.

3. Track growth and make regular observations. Water as needed. You can use the **Plant Growth Observation Worksheet** for your notes.

4. Continue your experiment for at least six weeks to allow students to observe any differences in growth that might occur.

Making Connections:

In addition to learning about the benefits of amending soil with compost for plant health, composting offers a wide range of environmental benefits and provides an opportunity for students to engage in an activity that can impact the ecosystem they live in. Composting at school or home can be a very rewarding endeavor. In addition to contributing to soil health, it decreases the waste going into landfills, decreases the need for fertilizers, and, by improving soil structure, can help with bigger community concerns like stormwater management and erosion control. Launching a composting program at school or providing support for composting at home or in the community can be a powerful activity for students.

Walk students through the process of making plans for a composting initiative:

- Investigate sources for compostable materials to collect. Compost materials could be the byproduct of garden or landscaping activities or from collecting organic waste from meals at home or in the cafeteria. Depending on the scale of the project, materials could be collected every day, once a week, or even just on special occasions or at specific events.
- Research composting techniques. Research the different composting techniques and decide which is

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best for the audience. Composting could be done using indoor worm bins, outdoor bins, or a mixture of both.

- Devise a collection process. Draft an efficient process for collecting food waste and for delivering it to planned bins.
- Create educational materials (brochures, PowerPoint presentations, videos) to inform friends, families, and community members about the planned composting initiative.
- If resources allow, use your planning to actually create a Compost Committee and launch a compost program.

Branching Out:

Water Investigations

Focus on how amending soil with compost impacts the water-holding capacity of soil. Repeat the experiment above, but track water needs and usage along with your observations related to plant health. Explore how compost impacts water absorption and efficiency.

Nutrient Investigations

Collect samples of garden soil and compost and use home nutrient testing kits to compare nutrient availability. Soil nutrient testing kits are available at garden centers and educational supply stores. Although they may not be as accurate as professional soil tests, they can approximate the levels of nitrogen, phosphorus, and potassium (the three nutrients plants need in the highest quantities) in soil and, in most cases, also the pH. Discuss your findings.

The Soil Story Curriculum

For additional middle school soil and composting lesson ideas, check out [The Soil Story Curriculum](#) from Life Lab and Kiss the Ground.

Related NGSS Disciplinary Core Ideas and Performance Expectations

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

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Senses Observation Worksheet

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Plant Growth Observation Worksheet

Container # Soil/Compost Ratio	Observations after 1 week	Observations after 2 weeks	Observations after 3 weeks	Observations after 4 weeks	Observations after 5 weeks	Observations after 6 weeks