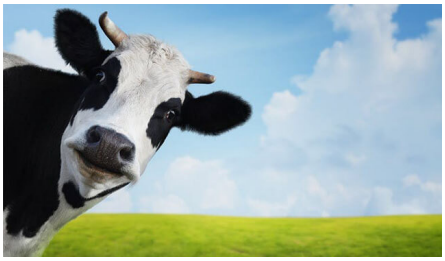
Lesson and Activity Suggestions for Grades 9 - 12

Why Did We Give You a Bag of Manure?

Manure is one of the best fertilizers for your garden. It improves the soil and helps your plants absorb water, oxygen and other nutrients, which are essential for their health. Other benefits of manure are that it's inexpensive, organic, readily available, and easy to mix into your garden soil.



Fertilizer and Amendment

Manure is both a fertilizer and a soil **amendment** *(material added to improve soil)*. Manure slowly releases nutrients into the soil that plants can easily absorb. Manure contains nitrogen, phosphorus, potassium and micronutrients, which are important for plant health. Nitrogen is the most important nutrient that plants need and is responsible for rapid plant growth and the green color of plants. Fresh manure has a very strong odor and is harmful to plants because it contains high levels of nitrogen and ammonia that can "burn" plants. Plants in contact with fresh manure will rapidly dehydrate, causing the leaves to turn brown and wither. This process is called **burning**.

Compost First

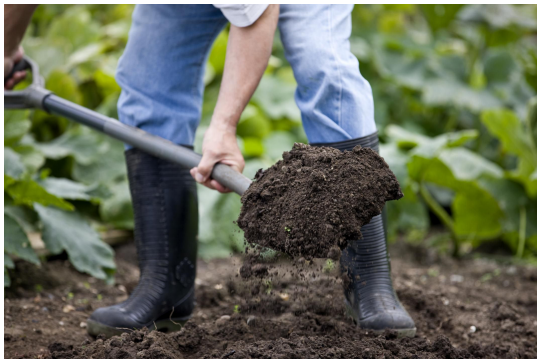
Before manure can be used to fertilize plants, it must go through an aging process called **composting**. In this process, fresh manure sits for 3 to 12 months. As the manure ages, nitrogen changes into a form that won't burn plants, and any **pathogens** (a virus or bacteria that causes disease) present in the manure are also killed. Another benefit from composting manure is that it loses its odor. (That's a big benefit!)

Cow manure is the most popular source of manure for plants because it doesn't contain high amounts of nitrogen and is less likely to burn plants. Other sources of manure for the garden are horses, chickens and rabbits. Based on the type of animal, manure has different levels of nitrogen. Rabbit manure has the highest level of nitrogen, followed by chicken, horse and cow manure, which has the lowest amount.

How to Apply Manure Compost

To apply the manure compost, add a two to three-inch layer of manure on top of existing soil and mix in well. Like cow manure, horse, chicken and rabbit manure are great for your garden, but because they have higher levels of nitrogen, make sure that they are not fresh and that they have been

composted. **Do not use manure from cats, dogs or pigs,** which contains dangerous pathogens that can make you sick. Fresh manure can be added directly to soil as long as there aren't any growing plants. If you are using fresh manure, mix it in with the existing soil in the fall and don't add plants until spring arrives. By then, the manure will have aged long enough so it won't burn plants. It is especially important not to apply fresh manure during the growing season to vegetable gardens, because the pathogens found in fresh manure can contaminate vegetables and make you sick.



Question 1: What is the most important nutrient that plants need?
Question 2: What are the two reasons why you should not use fresh manure?

Organic Versus Chemical

What's the difference of organic fertilizer or chemical fertilizer? Is one better than the other? Gardeners may choose to use conventional farming practices or organic ones. Many gardeners use elements of both approaches. Read the descriptions from www.AgClassroom.org of both types of fertilizers below, then list the advantages and disadvantages of each. Next, discuss this with your family or peers — what do they think? If you know any crop farmers, discuss this topic with them. They may have a very different perspective. Google this topic and you will find that many people have many different OPINIONS. Be sure to find the FACTS before you come to your conclusion.

Organic Fertilizers

Organic fertilizers usually contain little or no synthetic materials. They encourage the use of local natural resources. For example, animal manure is often used to fertilize plants. Organic fertilizers usually contain some nutrients that dissolve in water, but most of the nutrients are released slowly as microbes in the soil break down the organic material into forms that the plant roots can absorb. Organic fertilizers contain relatively low and unpredictable amounts of nutrients as compared with commercial fertilizers. The lower amounts of nutrients in organic fertilizers mean that farmers may need to use larger amounts of organic fertilizers in order to meet the needs of the crops. The balance of nutrients in organic fertilizer is often not what the crops need. This can mean that in order to supply the needed amount of nitrogen, for example, the fertilizer may also supply too much of another nutrient such as phosphorus. On the other hand, the lower nutrient amounts in organic fertilizers may make it less likely that crop plants will be damaged through exposure to excessive amounts of nutrients. Although organic fertilizers can be less expensive than commercial fertilizers, the use of organic fertilizers may produce lower crop yields. More land may be required to grow plants used to feed the livestock that produce the animal manure.

Commercial Fertilizers

Commercial fertilizers are produced through industrial processes. Commercial fertilizer is natural in the sense that its components come from natural mineral deposits or, in the case of nitrogen, from the air. These fertilizers contain nutrients in forms that crop plants can use. The amounts of each nutrient contained in commercial fertilizers are known precisely. This means that farmers know the exact amounts of nutrients applied to plants. A bag of commercial fertilizer is labeled with three numbers that describe the amounts of nitrogen, phosphorus, and potassium that it contains. For example, a bag labeled 15-5-10 contains 15 percent nitrogen, 5 percent phosphorus, and 10 percent potassium. In general, commercial fertilizers allow the farmer more control over plant nutrition than organic fertilizers because the amounts of nutrients in commercial fertilizers are precisely known and they are released in a more predictable way. Overuse of commercial fertilizers is more likely to occur as compared to overuse of organic fertilizers.

ORGANIC	
ADVANTAGES	DISADVANTAGES

COMMERCIAL	
ADVANTAGES	DISADVANTAGES

DIY Compost (without the Cows)

Compost is organic material that can be added to soil to help plants grow. We provided you with a bag of cow manure compost, but it can be made right at home and without any help from livestock. According the U.S. Environmental Agency, "Food scraps and yard waste together currently make up more than 28 percent of what we throw away, and should be composted instead. Making compost keeps these materials out of landfills where they take up space and release methane, a potent greenhouse gas." Plus, they provide nutrients in your garden to help grow more food for your family to enjoy. Visit https://www.epa.gov/recycle/composting-home to learn how to create your own compost from kitchen scraps and other organic materials.

Watch the Decomposition Happen

Decomposition is the process in which organic material is broken down into simpler forms of matter. It's natural recycling! When leaves fall and plants and animals die, they start this process of breaking down and decaying. Insects, bacteria, and fungus all carry out decomposition. In the end, dead matter decays and is turned back into soil.

To study composting up close, you can create your own mini compost bins in cups or jars, and see decomposition in action. It only takes a few supplies and easy steps.

Supplies Needed

- 16 ounce or larger clear plastic cup or glass jar
- Organic items such as kitchen scraps *(no meat or dairy)*, leaves, coffee grinds, grass, etc.
- Plastic wrap
- 1 tablespoon water
- 1/4 cup dirt
- Rubber band or tape

Instructions

1. Place enough organic items to fill the cup or jar 2/3 full.
2. Add the dirt and water.
3. Cover the cup or jar with plastic wrap and secure it with a rubber band or tape.
4. Carefully shake the cup or jar to mix up the ingredients.
5. Set it in a warm place that receives partial sunlight, indoors or out.
6. Every couple of days, take note of what you changes you see. Then, give the cup or jar another tablespoon of water, shake, and leave it again.

What You Should See

The warm environment inside the container increases the activity of the microbes, also inside. These bacteria and fungus go to work breaking down the organic matter. The added water and oxygen from the shaking keeps the process going. Within a day or two you can see this happening. Given enough time, you'll be able to see the organic matter turn into dark, nutrient rich compost that can be added to your garden.

Learn more and print out an infographic about composting at https://www.pbs.org/wnet/nature/blog/inside-nature-infographic-how-to-compost/