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|  | What is composting?  A compost pile recycles household and garden wastes by allowing billions of decay organisms to feed, grow, reproduce, and die in a process that creates an excellent organic fertilizer and soil conditioner. While composting, microorganisms break down organic matter and give off carbon dioxide, heat, water, and eventually produce humus, the stable organic soil end-product. Composting can be a very simple process. The composter can create a bin and throw in equal amounts of "browns", or dry plant materials and "greens", fresh plant materials. With occasional stirring and water, compost will happen. In contrast, the study of finding an optimum soil additive that enhances a plant's fertility and rate of growth can be more exacting. The reason that compost improves soil for most plants is because its finished product supplies the three essential ingredients -- potassium, nitrogen, and phosphorus -- to the surrounding soil. Plants flourish in an environment that offers an abundance of these ingredients and also benefit from compost's abilities to prevent disease, add needed aeration, and prevent erosion by rainfall.  What do Potassium, Nitrogen, and Phosphorus do?  Potassium-  Potassium is integral for the life processes of a plant including the manufacture and movement of sugars and starch, and the normal growth by cell division. Potassium is taken from the surrounding soil by the roots.  Nitrogen-  Nitrogen in soil regulates a plant's ability to make proteins that are important for the formation of the protoplasm of new cells. It is most active in the young, tender parts of the plant's tissues, such as tips of shoots, buds, and newly opening leaves.  Phosphorus-  Phosphorus is necessary for photosynthesis and provides the mechanism by which energy is transferred within a plant. It is used in all living tissue of the plant. There is an ideal range to the amount of phosphorus in the soil surrounding a plant. If the level of phosphorus falls into this range, then the root system will flourish.  (Sunset Western Garden Book p. 50)  Two Types of Composting  "Hot" Composting  Under ideal conditions, there will be three stages to composting: the mesophilic stage, the thermophilic ("hot") stage, and the cooling period, which can take several months.  Image from Cornell homepage  1. The mesophilic or moderate-temperature phase, lasts a few days and involves mesophilic organisms. These organisms break down the soluble, readily degradable compounds and give off energy in the form of heat. This heat leads to the steady increase of the pile's temperature.  2. Once the temperature reaches roughly 40 °C (104 °F), the thermophilic, or heat-loving microorganisms dominate. This heat speeds decomposition but it is necessary to aerate the pile consistently by stirring to prevent the temperature from exceeding 65 °C (145 °F). At this temperature, even thermophilic microorganisms break down, sterilizing the soil and defeating the purpose. During the thermophilic stage, fats, proteins, and complex carbohydrates (i.e. cellulose and hemicellulose) break down.  3. After the high-energy compounds are exhausted by the thermophilic organisms, the mesophilic microorganisms once again dominate. This marks the beginning of the curing stage of the compost. This curing stage lasts until all complex structures are broken down to their most basic forms. It is wise for a gardener to allow this process to continue as long as possible because mature compost is more stable and effective as an additive to soil. In mature compost, the food web becomes more complex, improving the local communities surrounding the young plant the compost fertilizes.  "Cold" Composting  In my experiment, I used a method known as cold composting. I used this slower, but equally effective method of composting for several reasons. The first reason was the small scale of my experiment, which required only a small amount of composted materials. The second reason was because I needed to be conservative with time. Surface area and volume are critical to the compost pile because there is a range of temperatures that the pile can reach without exceeding 65 °C. If the compost pile exceeds a certain volume (greater then roughly one cubic yard), there is not enough surface area to dissipate heat effectively. This leads to an overabundance of energy given off as heat and the sterilization of the compost. With cold composting I knew that overheating the pile would not be a concern and I could be sure to have a stable humus by the month of March.  In the process of cold composting, the pile is aerated by turning only once every week and only the mesophilic microorganisms break down the complex carbohydrates during the two to four month process. The temperature I measured in the piles ranged between 6°C (43 °F) and 19 °C (66 °F).  Planting  In order to test the compost that I created over a four month period (Nov. 1-March 1), I needed to design an experiment that would compare the two types of compost. I decided to use two types of plants, the early scarlet globe radish and the green leaf lettuce. I selected the radish because it would need a high amount of phosphorus and potassium for it's root system which forms the edible vegetable. I selected lettuce as my other plant, because it is a leafy plant that needs a high nitrogen content in it's surrounding soil. I hypothesized that the potato compost would benefit the radish more than the lettuce because the potato as a tuber plant and the radish as a root plant may share some immunities to disease and a need for similar nutrients. I further hypothesized that the lettuce compost would benefit the lettuce plants more then the radish plants because lettuce has a higher nitrogen content that would aid the above ground lettuce leaves.  I planted the lettuce and radish seeds to the specifications prescribed by the back of the seed package. The radish required a soil depth of 1/2 inch while the lettuce only needed 1/4 inch. The seeds were dispersed heavily along a soil line so I could later thin the sample size. I planted roughly forty seeds into each planter assuming that at least thirty should germinate (break the soil level).  In order to allow for maximum drainage (important for both lettuce and the radish) I purchased three plastic planters with two holes punched out of the bottom. The planters were 6 inches deep, 6 inches wide, and 18 inches long. I also used rocks underneath the soil to allow for aeration and drainage. I had to separate the lettuce samples into two of the planters (one type of compost per planter) and the other basin was used for the radish. I partitioned the radish planter because radish needs little space between each plant in order to fully mature.  After the plants matured, I used an Ohaus triple beam balance to find the masses of all of the samples left. Once I found the masses for every plant, I was able to find the average weight of every plant in each of the three planters. Once I found the four average weights, I was able to begin my analysis. Using a statistical procedure called a two sample T-test, I was able to judge whether the difference in the average weights happened by chance. By comparing the average weights of the plants rather than their above ground height, I was able to gauge the quality of the compost rather than the quality of the seeds or the nitrogen levels. I did not use planters with plain soil because I was testing if there was a relationship between the type of compost and the type of plant rather than weather the compost worked.  Compost Improves Soil  "Compost does several things to benefit the soil that synthetic fertilizers (and uncomposted soil) cannot do. First, it adds organic matter, which improves the way water interacts with the soil...Compost also inoculates the soil with vast numbers of beneficial microbes and the habitat that the microbes need to live. These microbes are able to extract nutrients from the mineral part of the soil and eventually pass the nutrients on to the plants" [(Rot Web)](http://net.indra.com/~topsoil/How_to_Compost.html). |

*This Web Site is Best viewed with 256 or more colors.*

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